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WATER ENFORCEMENT & COMPLIANCE
ASSURANCE BRANCH, EPA, REGION 5

September 25, 2012

Mr. Donald R. Schwer III
Enforcement Officer/Agricultural Engineer
Water Division, Enforcement & Compliance Assurance Branch
EPA Region 5
77 W. Jackson Blvd. (WC-15J)
Chicago, IL 60604

RE: Town of Griffith, Indiana
Docket No. V-W-12-AO-08

Dear Mr. Schwer:

As requested, enclosed is a copy of the Sewer System Evaluation Study (SSES) prepared by Lawson-Fisher Associates for the Town of Griffith dated January, 1996. The Town would welcome meeting with you once you have completed the review of the Alternatives Analysis submitted on August 14, 2012.

If you have any questions or need any additional information, please do not hesitate to give us a call.

Very truly yours,

LAWSON-FISHER ASSOCIATES P.C.

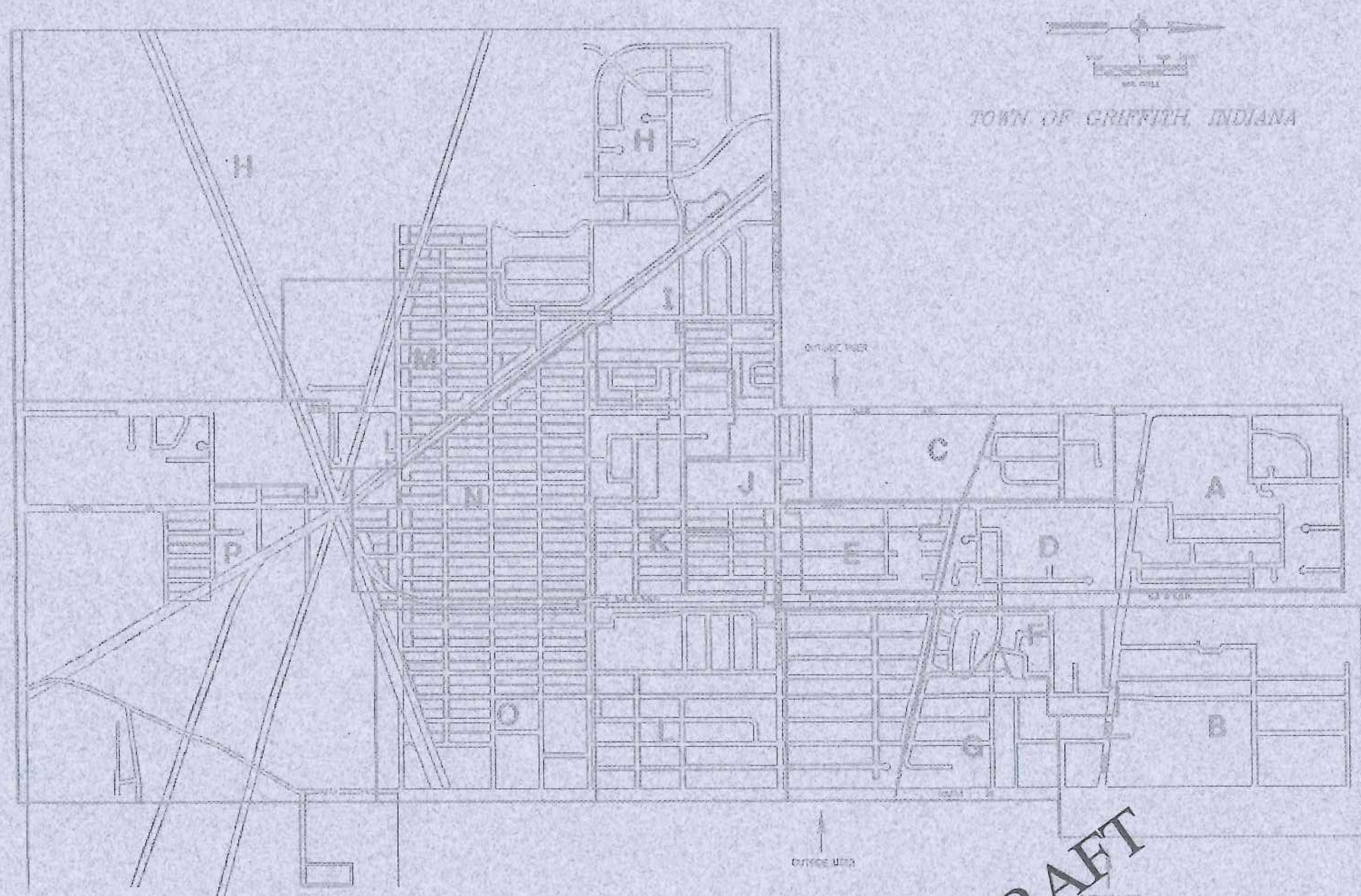
Dennis A. Zebell

Dennis A. Zebell, P.E.
Senior Civil Engineer

DAZ/cas
Encls.

TOWN OF GRIFFITH

SEWER SYSTEM EVALUATION SURVEY



DRAFT
1/31/96

JANUARY, 1996

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CONSULTING ENGINEERS
525 WEST WASHINGTON AVENUE • SOUTH BEND, INDIANA 46601
PHONE: (574) 234-3167

TOWN OF GRIFFITH

SEWER SYSTEM EVALUATION SURVEY

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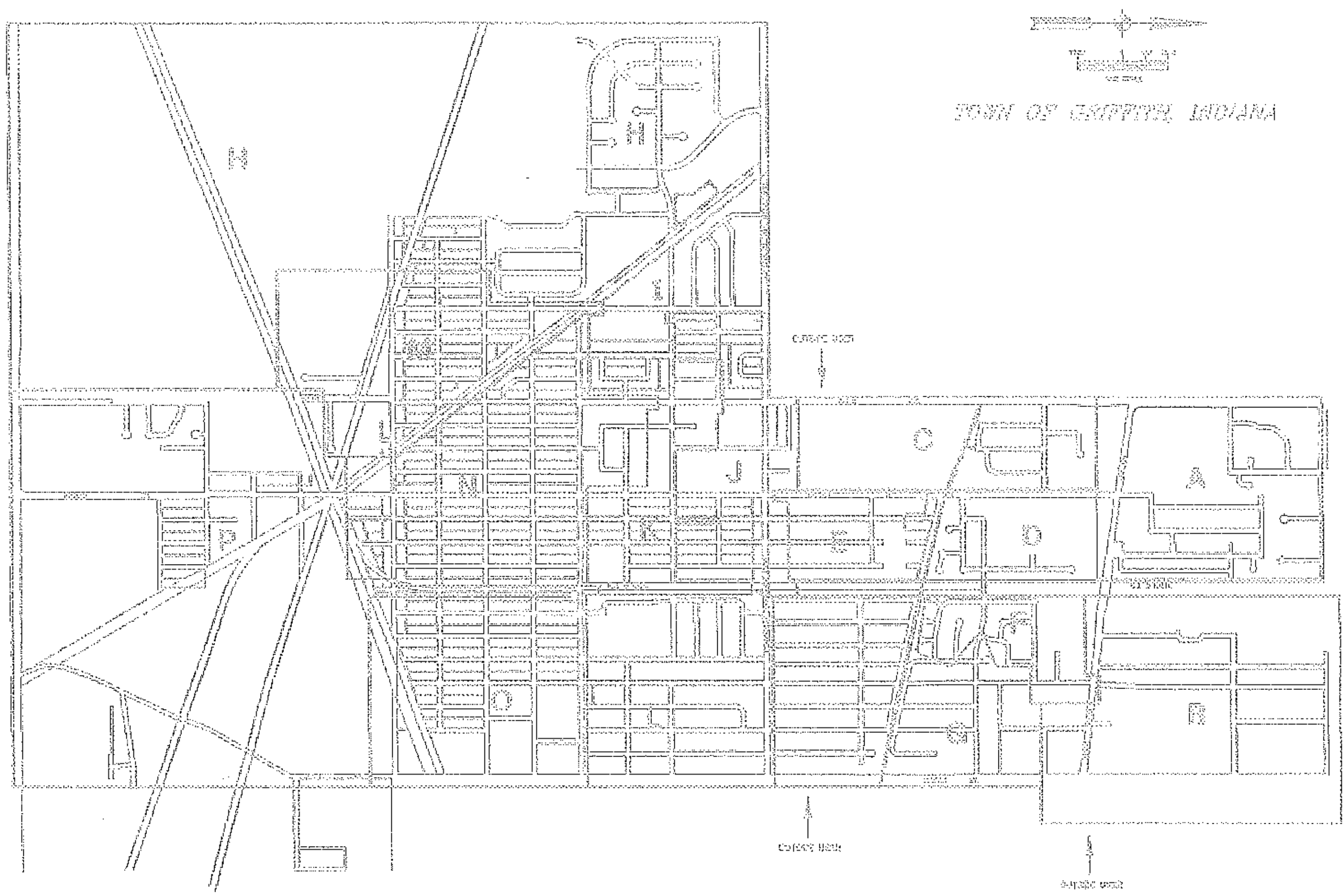
JANUARY, 1996


TOWN OF GRIFFITH, INDIANA
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SEWER SYSTEM EVALUATION SURVEY
FOR
TOWN OF GRIFFITH, INDIANA

JANUARY, 1996

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1/31/96

John E. Fisher, P.E., Partner

TOWN OF GRIFFITH

SEWER SYSTEM EVALUATION SURVEY

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SEWER SYSTEM EVALUATION SURVEY

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FIGURES

TABLES

I. INTRODUCTION

The Town of Griffith serves its population with a sewer system. The sewer system collects wastewater from residences, commercial buildings, industrial buildings and government institutions. The wastewater is then conveyed to the Hammond Sanitary District's Sewer System.

Circumstances have arisen which have given cause to the Town of Griffith Department of Public Works and the Town Council that the capacity of the sewer system may be overburdened. In order to determine the potential causes and to plan for the future operation of the sewer system, the Town Council is performing a Sewer System Evaluation Survey (SSES).

The Sewer System Evaluation Survey requires the collection and evaluation of the following information:

- Domestic and industrial daily water consumption data
- Historical wastewater flows for wet and dry periods
- Present wastewater flows for wet and dry periods
- Geographical, geological and climatological characteristics of the service area
- Types of sewers, layout, methods of construction, age, sewer depths, general structural conditions and operation and maintenance practices

This report is a compilation of the aforementioned information and data and an analysis of the condition of the sewer system. In addition, this report outlines potential work to be performed to remediate physical problems found during field investigations and to implement regulations, policies and procedures that will enable the Town of Griffith to maintain adequate control of the sewer system. Finally, this report creates a detailed work plan including additional television inspection, field investigation, equipment procurement and construction projects contingent upon, but not limited to, such factors as cost-effectiveness and current regulations.

The use of the terms "recommendation" or "recommend," "must," "should" or "shall," as those terms are utilized in any of the six sections of this Sewer System Evaluation Study, including its appendices, stem from the collection and evaluation of data reflected in said study and appendices, together with general and well known principles of engineering and a careful application of the EPA guidance handbook "Sewer System Infrastructure Analysis and Rehabilitation" (EPA/625/6-91) (October, 1991). None of those terms, in any way imply that laws or rules are being violated nor impose fault on any person or entity. Furthermore, none of those terms impose a mandate.

It is firmly advised and counseled that before a given "recommendation" (or like terms) is followed, the following three-part analysis be undertaken:

First, will the recommendation, if completed, reduce or lead to a reduction of excessive inflow and infiltration as defined and set forth in Section 22 of the EPA's "Sewer System Infrastructure Analysis and Rehabilitation?"

Second, is there adequate, currently available funding for the recommendation?; and,

Third, is the recommendation cost effective, i.e. does the cost of the given recommendation justify the extent of benefits to the Town, whether in the form of money savings or reduction in excessive inflow and infiltration as defined and set forth in Section 2.2 of the EPA's "Sewer System Infrastructure Analysis and Rehabilitation," or are there more reasonable alternatives or other higher priority projects or problems currently in existence?

The Sewer System Evaluation Study and its appendices, whether in its draft form for discussion purposes or whether in its final form as incorporated in this decree, contains an enormous amount of raw data, impressions, conclusions and recommendations. All such data contained in said study and its appendices were obtained and submitted to the United States in an effort of compromise and settlement and, as such, are not to be considered as judicial findings of fact or conclusions of law for any purpose, in any way at any time.

II. SYSTEM OVERVIEW

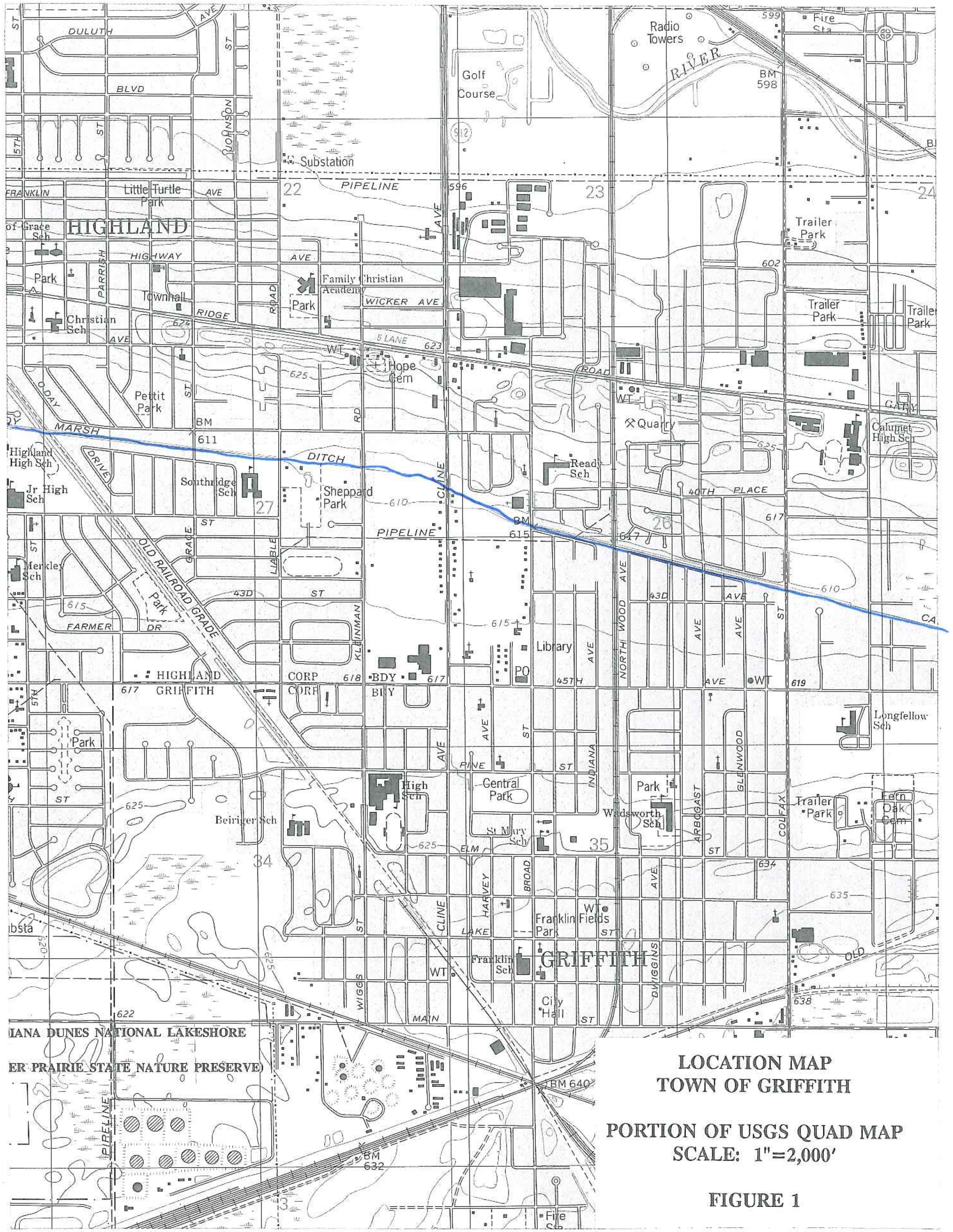
A. PHYSICAL CONDITIONS

1. Topography and Soils

The Town of Griffith is located in the Calumet Lacustrine Plain of former glacial Lake Chicago. This plain is characterized by three ancient beaches that extend southward from Lake Michigan for approximately 9 miles along the eastern boundary of Lake County and approximately 13 miles along the western boundary. The three beaches step upward in the southern direction from the Lake.

The boundary between the second and third ancient beach is marked by Ridge Road at an elevation of 625′ above mean sea level. To the north of Ridge Road, the Town's topography slopes downward towards the Little Calumet River. To the south, the Town's topography slopes less steeply downward towards the Cady Marsh Ditch which serves as the principal drain for the Town south of Ridge Road. South of the Cady Marsh Ditch, the topography of the land gently slopes upward.

With the exception of the southernmost section of Town where the topography is characterized by small sporadic knolls and hills, the topography rises and falls gently parallel to the Lake Michigan shoreline. (See Figure 1.)



LOCATION MAP
TOWN OF GRIFFITH

PORTION OF USGS QUAD MAP
SCALE: 1"=2,000'

FIGURE 1

According to the Soil Conservation Service's Soil Survey of Lake County, Indiana, the two predominant soil Associations within the Town of Griffith are the Plainfield-Watseka Association and the Maumee-Bono-Warners Association. The Plainfield-Watseka Association contains moderately sloping to nearly level soils that are both excessively drained and somewhat poorly drained. The Maumee-Bono-Warners Association contains depressional and nearly level soils that are very poorly drained. The soil types in the Town of Griffith are the result of glacial deposits and glacial, glaciofluvial, shallow-water coastal and lake, wetland and windblown sedimentation. The soils range from sand and gravels to silt, loam, clay and peat. The following soil types are present in the Town of Griffith:

- Brems fine sand
- Darroch Loam
- Maumee loamy fine sand
- Maumee silt loam
- Pewamo silty clay loam, calcareous variant
- Plainfield fine sand
- Rensselear loam
- Sparta fine sand
- Tawas muck
- Watseka loamy fine sand
- Wauseon fine sandy loam

2. Climate and Precipitation

The Town of Griffith is located in a temperate climate zone typical of areas in the midwestern section of the United States. Four distinct seasons, Winter, Spring, Summer and Fall occur throughout the year. The climate in the Town of Griffith is characterized by wide variations in temperature. The maximum and minimum temperatures during the study period were 93° F on June 17, 1994 and -21° F on January 18, 1994. (See Appendix F for a complete listing of daily high and low temperatures.) Winds from Lake Michigan provide a cooling effect in Spring and Summer and a warming effect in the Fall and Winter modifying the Town's extreme temperatures.

The frequency of precipitation events in the Town is fairly well distributed throughout the year. Rainfall is generally predominant in the Spring and early Summer. Snowfall occurs sporadically in Fall and regularly in the Winter. However, the intensity of storms varies dramatically depending on the year. The average annual rainfall for the area according to data gathered at the Hobart National Weather Service Cooperative Weather Station is 34.6 inches while the average annual snowfall is 39.2 inches. The frequency and intensity of storms during the study period was average.

3. Groundwater Conditions

A high groundwater table exists throughout the Town of Griffith. Static groundwater gages were installed in manholes throughout the Town to monitor the position and movement of the groundwater table. In many areas, especially the south and southwest part of Town, the ground is inundated and displays the characteristics of wetlands. In most other areas, the groundwater ranges between 2′ and 8′ below the ground. Periodically throughout the year, eighty-five percent of the sewer system is below the groundwater table. Portions of Subsystem C, located on high ground, are above the groundwater table during the entire year. (See Appendix G for a summary of the groundwater elevations at the static groundwater gages and a groundwater isocline map.)

4. Storm Sewers

The Town of Griffith has a separate storm/sanitary system. The existing storm sewer typically provides relief along streets and easements. Storm water is conveyed from most of the Town's land surface to the Cady Marsh Ditch which is tributary to the Hart Ditch. (The Hart Ditch is tributary to the Little Calumet River.) The storm water is discharged into the Cady Marsh Ditch through storm water discharge structures equipped with flap gates and a series of storm water pumping stations.

The principal storm water pump station is the Wood Street Pump Station. The Wood Street Pump Station services most of the Town south of the Cady Marsh Ditch. A 66" pipe from the south along Wood Street and a 24" pipe from the east along Brinwood Drive deliver storm water to the pumping station.

Two storm water detention basins were built in recent residential developments in the south west section of Town to relieve the storm sewer system during heavy rain events. These detention basins located at Reuth Street and Pine Street and at Lake Street and True Street contribute storm water to the Wood Street Pump Station through the 66" pipe along Wood Street.

B. DEMOGRAPHY AND LAND USE

The Town of Griffith's population as reported in the 1990 census is 17,914 people living in 6,914 households. The primary development in the Town is residential with approximately 70% of the people residing in single family homes, while the remaining 30 percent reside in apartments. In addition, approximately 460 commercial and industrial businesses are located in the Town. The Griffith Public School system consists of four elementary schools, one middle school and one high school that co contribute to the sewer system. Approximately 2,600 students are enrolled in the school system. The following is a list of all the public schools in the Town of Griffith:

- Beiriger Elementary School
- Eldon Ready Elementary School
- Elsie Wadsworth Elementary School
- Franklin Elementary School
- Griffith Junior High School
- Griffith Senior High School

Additionally, there are approximately 400 students enrolled at St. Mary's Parochial School.

The land area of the incorporated Town of Griffith consists of approximately 7 square miles that are easily divided into seven, one mile square, sections. The zoning districts are divided between residential and non-residential districts. Residential districts are further subdivided into one-family, two-family, multiple family and medium density multi-family districts. Similarly, non-residential districts are subdivided into office service, local business, central business, general business, research office, light industrial, general industrial, vehicular parking and commercial districts. (See Appendix P for the map detailing the locations of the zoning districts.)

C. SEWER COLLECTION SYSTEM

1. Gravity Sewers

The Town of Griffith's Sewer Collection System includes approximately 53 miles of 8 to 42 inch pipes within approximately 7 square miles. The system is a series of collection lines that flow into transport lines that flow into a large interceptor. The interceptor begins at the south end of the Town and flows north to the Cline Avenue Pump Station. The Cline Avenue Pump Station pumps the sewage through a 14 inch diameter force main to the Hammond Sanitary District sewer system.

A subsystem and microsystem approach was used to decrease the size of the flow monitoring areas to 8,000 - 10,000 linear feet (LF). The estimated amount of pipe in each subsystem is summarized in the following table.

Subsystem	Quantity of Pipe (LF)
Interceptor	23,000
A	13,380
B	14,195
C	8,115
D	9,540
E	8,295
F	8,630
G	25,785
H	30,010
I	7,320
J	16,190
K	14,655
L	21,220
M	13,180
N	32,785
O	20,965
P	11,990

2. Pumping Facilities

The Town of Griffith operates four pump stations within the sewer system. These pump stations are located at:

- Cline Avenue, South of the Little Calumet River
- North of the intersection of River Drive and North Lafayette Court
- Northeast corner of intersection of Rueth Street and Pine Street

- South of Main Street, East of Lindberg Avenue

3. Wastewater Treatment Facilities

   The Town of Griffith does not operate a Wastewater Treatment Facility. Wastewater is pumped from the Cline Avenue Pump Station to the Hammond Sanitary District's gravity sewer system. From that point, it flows to the Hammond Sanitary District Wastewater Treatment Plant.

4. Outside Users

   Several organizations located outside of the Town hold agreements with the Town of Griffith to discharge sewage into the system. The following is a list of organizations that are classified as Outside Users:

   - Black Oak Elementary School
   - Calumet Senior and Junior High School
   - Lake Ridge Middle School
   - Longfellow Elementary School
   - Midstates Distributors
   - Ross Reformed Church
   - Strack and Van Til

   The locations that the Outside Users discharge into the Town's Sewer Collection System are identified in Appendix A.

III. INFORMATION COLLECTION

A survey was conducted to gain a comprehensive understanding of the existing sanitary and storm sewer systems servicing the Town of Griffith. The sewer system characteristics that were researched included:

- the layout of the collection system
- the locations of pumping stations, overflows and basins
- the size, length and type of pipe
- the historical sewer system flows and performance
- the type and location of sewer system users
- the geological and climatological factors influencing the system

A. OFFICE INVENTORY

The following resources were gathered from the Town of Griffith Department of Public Works, Building Inspector, Clerk-Treasurer, Griffith Public Schools and the Lawson-Fisher Associates library.

- As-built maps of the Sewerage Improvement Project of 1959, Divisions I-IV

- As-built maps of the Sewerage Improvement Project of 1977, Divisions A-L

- Sanitary Sewer System Study of September, 1992

- United States Department of the Interior Geological Survey, 7.5 Minute Series (Topographic) Highland Quadrangle, Indiana-Lake County

- United States Department of Agriculture, Soil Conservation Service, Soil Survey of Lake County, Indiana

- Town of Griffith water usage billing records

- 1990 United States Census information

- Various plans and as-built drawings of subdivisions and improvements.

B. FIELD SURVEY

A field survey was conducted to determine:

- the physical condition of manholes
- the location of existing sewers
- the suitability of manholes for metering
- the elevations of the manholes, rims and inverts

In addition, data was acquired to support unique findings specific to geographical locations such as, cross connections, ponding, etc.

The methods used to complete the field survey included the following:

- Manhole Inspections
- Confined Space Entries
- Interviews
- Dye-Water Testing
- Television Inspections
- Photographs
- Groundwater Gaging
- Staff Gaging
- Precipitation Measurement
- Temporary Benchmark Survey

- Level Circuit Survey

1. Manhole Inspections

   Manhole inspections were used to assess the operating condition of the manholes and identify problem areas that could contribute to inflow or infiltration. Inspections provided information on the exact location of manholes, the susceptibility to ponding or runoff and the configuration of the incoming and outgoing lines.

   Manhole inspection sheets were completed for all manholes that were opened and inspected (See Appendix B). Manhole inspections have been completed for:

   - manholes located on the interceptor
   - manholes used as metering sites (See Section IV and Appendix I)
   - manholes immediately upstream and downstream of the metered manholes

2. Confined Space Entry

   Confined Space Entry was required when entry was necessary to:

   - install area-velocity meters
   - install static groundwater gages
   - conduct detailed manhole inspections

   Appropriate OSHA and local regulations were strictly observed and entries were conducted by qualified personnel. All confined space entry permits are included in Appendix C.

3. Interviews

   Interviews were conducted with Town officials and residents to identify suspected sewer failures and patterns associated with rain events. Interviews provided valuable information in assessing pipeline conditions and in establishing priorities for rehabilitation, replacement and engineering analysis. The interviews also helped to identify areas with sewer back-ups and flooded basements. Such occurrences could be indications of infiltration problems.

4. Dye-Water Testing

   Dye-water testing, a rainfall and snowmelt simulation technique, was used to identify specific defects that could contribute to infiltration and inflow. Additionally, dye-water testing was used to identify suspected system cross-connections, improper connections and piping routes.

A fluorescent green dye was used to provide a distinct color that was readily detectable in low light conditions. It was biodegradable, miscible in water and inert to solids and debris.

5. Television Inspection

Television inspections of sewer lines were performed to establish the integrity of lines suspected of potential infiltration or inflow, to identify service laterals and to obtain flow obstruction information.

Closed-circuit video systems designed for sewers were used to televise sewer lines. The videotapes could be used to generate reports, to estimate infiltration rates and to provide documentation of system integrity.

6. Photographs

Photographs were taken of each inspected manhole and attached to the manhole inspection sheets. Photographs provided a concise documentation of existing conditions, graphically augmented reports and established a permanent visual record.

7. Groundwater Gaging

Static groundwater gages (i.e. piezometers) were installed in seven manholes located throughout the Town of Griffith. Groundwater elevations indicative of potential infiltration were considered an intricate part of the Infiltration and Inflow Study. Thus, groundwater gages were installed to obtain an accurate representation of groundwater patterns.

8. Staff Gaging

Staff gages were placed at the Cady Marsh Ditch and Little Calumet River to monitor stream elevation patterns. Water surface elevations were recorded to provide information on possible infiltration.

9. Precipitation Measurement

Precipitation measurements were required to quantify rain events for the Town of Griffith. Rainfall was correlated with flow data to determine the amount of inflow entering the sewer system. A graduated cylinder located at the Cline Avenue Pump Station was read to obtain rainfall measurements for a given 24 hour period.

10. Temporary Benchmark Survey

Temporary benchmarks (TBMs) were established throughout the Town of Griffith. The temporary benchmarks provided a reference elevation in feet above mean sea level. The locations and elevations of the temporary benchmarks were documented on the subsystem maps and are included in Appendix D.

11. Level Circuit Survey

Level circuit surveys traverse the following:

- inspected manholes
- metered manholes
- manholes upstream and downstream of the metered manholes.

IV. FLOW MONITORING PROGRAM

A. DEFINITION OF PROBLEM

A Flow Monitoring Program was implemented for the Town of Griffith to determine the origin, amount and location of clear water entering the sewer system. Ultimately, the water entering the system originated from rainfall and groundwater and is referred to as inflow and infiltration, respectively. The Flow Monitoring Program consisted of data collection concerning daily water usages, rainfall events, groundwater table elevations and wastewater flow rates and quantities. With this information, the origin and amount of inflow and infiltration entering the system was quantified.

The February 11, 1974, Federal Register, "Title 40 Rules and Regulations," Section 35.905, defined infiltration and inflow. The second edition of the ASCE-Manuals and Reports on Engineering Practice No. 62 Existing Sewer Evaluation & Rehabilitation defined rainfall induced infiltration. These terms are listed below:

1. Infiltration - The water entering a sewer system and service connections from the ground through such means as, but not limited to, defective pipes, pipe joints, connections or manhole walls. Infiltration does not include and is distinguished from inflow.

2. Inflow - The water discharged into a sewer system and service connections from such sources as, but not limited to, roof leaders, cellar, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, storm water, surface runoff, street washes or drainage. Inflow does not include and is distinguished from infiltration.

3. Rainfall-induced infiltration - The water entering a sewer system and service connection resulting from changes in subsurface conditions as a result of rainfall infiltrating the soil. Rainfall-induced infiltration is characterized by a maintained increase in wastewater flow for days following a rainfall event.

B. WATER USAGE

The 1991 EPA Handbook on Sewer System Infrastructure Analysis and Rehabilitation emphasizes the importance of population information and water usage data in determining theoretical or base wastewater production rate. The theoretical wastewater production rate represents the total quantity of sewage produced by all system users, excluding any extraneous flow sources. This baseline sewer flow is essential in the evaluation of system inflow and infiltration.

During the Flow Monitoring Program, the theoretical wastewater production rate for the Town of Griffith was established from water usage billing records and a listing of water and sewer utility customers. A Total Water Usage figure for each month was obtained from the sales tax summary reports. Based upon the billing records and the account listing, sewer and water users were divided into the following categories:

- Public (Sales Tax Exempt)
- Large Volume
- Commercial/Industrial
- Residential.

Based on the above classifications, the Total Water Usage in Griffith was distributed among the sewer subsystems to establish base flows.

Each customer category required a separate assessment before the base wastewater production rate could be established. Since they exhibited consistent usage practices, the usage values for both the Commercial/Industrial and Residential classifications were computed on a pro-rated basis. This eliminated the task of assessing each utility account individually.

1. Public Users

Public Usage was determined from a list of sales tax exempt churches, civic organizations and government offices. Water usage values were computed on a monthly basis from January 1994 to March 1995. These values were derived from the water consumption billing rate and the amount billed to each user. Because the water consumption billing rate prior to January 1994 was not available, the 1994 billing rate was used to estimate the water usage for June 1993 through December 1993. The sales tax exempt users and their locations are listed in Appendix E.

2. Large Volume Users

Users with average monthly water usage rates near or above 100,000 gallons were designated as Large Volume Users. Since several Large Volume Users exhibited highly variable usage rates, their water usage was compiled from their monthly water bills. By isolating these users and compiling their water usage as described, the accuracy of the baseline flow estimates was increased.

A list of 23 Commercial/Industrial Users that have been designated as Large Volume Users follows:

- Subsystem A

  Bulkmatic
  Frank's Nursery
  Pepe's Restaurant
  Popeye's Restaurant
  Venture Store
  White Castle Restaurant

- Subsystem B

  Mansards Apartments
  Modern Way Cleaners

- Subsystem C

  Strack & Van Til

- Subsystem F

  J & E Properties

- Subsystem I

  Danrick Apartments
  Fountain Head Condominiums
  Lilian Courts
  R.C. Bonner

- Subsystem L

  Andover Apartments
  Auto Washboard II
  Griffith Apartments

- Subsystem M

  Packaging Corporation of America (also has private wells)

- Subsystem O

  La Salle Steel
  Smith Victoria Corporation

- Subsystem P
  American Chemical Corporation

- Non-Sewer Users

  Colfax Trailer
  Griffland Village, Inc.

The individual monthly water usage totals for the Large Volume Users are listed in Appendix E.

In the case of Andover Apartments, J & E Properties and Lilian Courts, the large number of separate accounts did not allow a simple compilation of exact water usage totals. For these complexes the water usage values were approximated based on the usage histories of all other apartment complexes in Griffith.

A ratio of water used each month relative to usage in the month of May 1994 was computed based on the compiled billing records of all other apartment complexes. Knowing the exact water usage in May 1994, the remainder of three complexes usage histories was approximated.

3. Commercial/Industrial Users

Apart from the 23 Large Volume Users, there are 505 Commercial/Industrial customer accounts in the Town of Griffith. The majority of these users exhibited similar water usage practices, which allowed pro-rating. In an effort to refine the water usage estimate, the Commercial/Industrial customer classification was further subdivided into two categories: heavy water users and light water users.

Heavy users were defined as those commercial and industrial users that consume more than 10,000 gallons per month. Similarly, light water users consume less then 10,000 gallons per month. Using the month of May 1994 as a model, it was determined that 60 commercial and industrial consumers were heavy water users. These 60 consumers accounted for approximately 4.2% of the remaining usage (total usage less public and large volume usage). All other months revealed similar numbers of heavy commercial and industrial users. Thus, based on the percentage computed for May 1994 and the assumption that there will consistently be 60 heavy users per month, the heavy commercial and industrial usage was computed for the remaining months of the flow monitoring period.

Given the assumption that there are 60 heavy users each month, the remaining 445 commercial users were considered light water users. Because most of these commercial businesses are relatively equal in size and do not display highly variable water demands, they would have similar wastewater production rates. This made it possible to pro-rate the monthly total commercial usage for each subsystem on a per-business basis.

4. Residential Users

Water usage for residential users was calculated on the same basis as light commercial/industrial users. It was assumed that light users display average monthly usage rates equivalent to the average monthly usage of a typical residential user. Thus, the remaining usage (total usage less public usage, large volume usage and heavy commercial and industrial usage) was pro-rated on a per-business/per-household basis among the 7,214 light commercial/industrial users and residential users.

Appendix E contains individual water usage worksheets for the customer classifications defined above. These sheets display water usage figures for sewer Subsystems A through P. An additional value is shown for those customers that use water, but do not contribute wastewater flow to the sewer system. This is labeled with an asterisk (*). These figures are provided for June 1993 through March 1995.

In addition to these worksheets, Appendix E includes a table which lists each metering site that was part of the Flow Monitoring Program and the water usage customers contributing to the baseline wastewater flow.

C. RAINFALL EVENTS

Flows in a sewer that exceed the theoretical wastewater production rate may originate from a variety of sources. These sources are defined as inflow, infiltration, rainfall-induced infiltration or improper disposal of wastes into the system. Information concerning rainfall events was critical to differentiate between each type of excessive flow.

Rainfall events were recorded at one location within the contributing sewer system's boundary during the temporary flow metering period. An existing rain gage at the Cline Avenue Pump Station, installed and maintained by the Town, was used for the purposes of this study. The intent of the rain gage was to measure the amount of rainfall in inches for a 24-hour time period. Town of Griffith personnel measured and recorded rainfall information daily. The Department of Public Works supplied a compilation of the daily rainfall totals each month.

D. GROUNDWATER TABLE ELEVATIONS

As discussed, flows that exceed the theoretical wastewater production rate may originate from inflow, infiltration, rainfall-induced infiltration or improper disposal of wastes into the system. Groundwater table information was critical to differentiate between these forms of excessive flow.

Groundwater table elevations were recorded at seven locations within the sewer system for the entire temporary flow metering period. Static groundwater gages were installed in sewer Manholes A-13, B-2, D-1, I-2, K-3, M-8 and N-16 before the metering program began. (See Appendix G for the location of the static ground water gages.) An Electronic Water Level Meter was used to measure the depth of the groundwater below the rim of the manholes. Thus, groundwater elevations are determined at the manholes by subtracting the depth of water below the rim of the manhole from the rim elevation.

The gage at Manhole D-1 was rendered inoperable in May 1994. A leak in the manhole wall caused a cone of depression around the manhole lowering the groundwater table below the intake tube of the gage. Any data obtained from this manhole was determined to be unreliable and was discarded.

Eagle Point software was used with the piezometric data to generate contours of the groundwater table throughout the system. With this map, the possibility of rainfall or groundwater induced infiltration was determined.

E. FLOW METERING PROGRAM

A Flow Metering Program was organized to quantify and to determine the origin of the hydraulic load placed on the Town of Griffith's sewer system. The Flow Metering Program consisted of system monitoring, subsystem monitoring, microsystem monitoring and outside sources monitoring.

The objective of system monitoring was to quantify the hydraulic loading on the entire sewer system servicing the Town of Griffith.

The objective of subsystem monitoring was to determine and rate the present condition of each subsystem in the sewer system.

The objective of microsystem monitoring was to isolate point sources in the subsystems that experience excessive loading.

Finally, the objective of outside source monitoring was to identify and quantify the amount of sewage contributed to the system by sources outside the incorporated limits of the Town of Griffith.

1. Selection of Key Manholes

The selection of key manholes to isolate subsystems, microsystems and outside users is summarized in the following table. It is important to note that several subsystems required more than one key manhole to monitor the flow within that subsystem. In addition, key manholes for microsystems were selected to separate subsystems with observed excessive flow and isolate the point source of the excessive flow.

Subsystem	Subsystem Key Manhole(s)	Microsystem Key Manhole(s)
A	A-8, A-11, A-14	
B	B-01	B-02, B-04
C	C-05	
D	D-01, E-02, C-05	
E	E-02	
F	F-01	F-04
G	37	
H	I-03	H-03, H-66
I	I-01, I-03, M-03	I-01b
J	44	J-10, J-13
K	I-01, K-01, N-02	K-03, K-06
L	L-02	L-09
M	M-03	M-15
N	N-02	
O	52	
P	53	

2. Temporary Flow Metering Schedule

A temporary flow metering schedule was established to minimize the time collecting field data and to maximize the amount of useful data collected. The primary objective of the temporary flow metering schedule was to meter long enough in each subsystem and microsystem to collect data during several rain events and several dry periods.

Based on prior metering experience in the area and knowledge of the climatological trends, two to three weeks of metering at a single subsystem or microsystem was the optimum time period to satisfy the primary objective and to remain within the time constraints of the project. After two to three weeks of metering, the flow meters were removed and installed in different key manholes.

3. Automatic Flow Metering Equipment

Two types of flow meters were used to measure the rate and amount of flow through key manholes: ISCO 3210 flow meters and ISCO 4150 flow loggers.

ISCO 3210 flow meters with ultrasonic level sensors were chosen to measure the amount of flow passing through key manholes. The ISCO 3210 flow meters did not measure flow directly. Instead, they measured the depth of flow which was converted into a flow rate using a calibrated relationship between the depth of flow in a partially full circular pipe and the flow rate. The ISCO 3210 flow meters were chosen for several reasons:

- Small, lightweight, durable meter was easy to install and maintain without entering manholes.
- Completely sealed steel reinforced sensor cable was easy to install and maintain.
- Ultrasonic level sensor measured depth of flow without contacting the liquid.
- Data was recorded and stored in digital format.
- Measurements were recorded automatically every. two minutes
- Associated ISCO PC software FLOWLINK 2.14 made data manipulation easy.

ISCO 4150 flow loggers with depth and velocity sensors were also used to measure the amount of flow passing through key manholes. The ISCO 4150 flow loggers were advantageous because they are installed directly into the upstream pipe of a key manhole. ISCO 3210 flow meters could not be used, in manholes with drop pipes, less than 300′ of straight pipe or with more than one pipe entering. Thus, the ISCO 4150 flow loggers made it possible to isolate systems that could not be isolated with the ISCO 3210 flow meters.

4. Installation of Flow Meters

The following procedure was used to install the ISCO 3210 flow meters in key manholes:

- The manhole lid was removed and the manhole was inspected.
- If needed, a confined-space entry procedure was performed.
- The ultrasonic level sensor was carefully positioned over the center of flow.
- The memory partition within the flow meter was created using a laptop computer equipped with ISCO LAPCOMM software. The setup required field personnel to clear any existing data in the memory partition, identify the location of the meter, establish the method of data storage, establish the interval of data storage, synchronize the flow meters internal clock with the time on the laptop and enter the existing depth of flow.
- The flow and sediment depth in the pipe at the transducer was manually measured and compared to the flow depth read by the meter. This was done to ensure the accuracy of the data.
- The flow meter was suspended from a spreader bar positioned across the top of the manhole and a security line was attached to a manhole rung.

Similarly, the following procedure was used to install the ISCO 4150 flow loggers in key manholes:

- The manhole lid was removed and the manhole was inspected.
- A confined-space entry was performed to insert an area-velocity sensor mounted to a stainless-steel band in the upstream pipe of the appropriate flow channel.
- The memory partition within the flow logger was created using a laptop computer equipped with ISCO Flowlink 3 software. The setup required field personnel to clear any existing data in the memory partition, identify the location of the meter, establish the method of data storage, establish the interval of data storage and synchronize the flow meters internal clock with the time on the laptop.
- The depth of flow in the pipe over the transducer was measured manually and compared to the flow depth read by the meter. This was done to ensure the accuracy of the data.

- The flow meter was suspended from a spreader bar positioned across the top of the manhole and a security line was attached to a manhole rung.

5. Interrogation and Maintenance

A weekly interrogation and maintenance schedule was implemented to minimize the loss of data and flow metering time. Without interrupting operation, the flow meters were interrogated in the field using a laptop computer. In the office, the computer data was transferred to 3.5" diskettes and reviewed to insure that the meters were recording data properly.

The flow meters were routinely inspected upon completion of the interrogation. If a flow meter was not operating properly, it was removed and replaced. In addition, flow meters were alternated between manholes if they required general cleaning, maintenance or calibration.

6. ISCO 3210 Flow Meter Theory

The ISCO 3210 flow meter and ultrasonic level sensor measured the depth of flow by emitting an ultrasonic beam which reflected off the liquid level and was received back by the level sensor. The time that it took for the beam to travel was measured by the flow meter. Since the elapsed time was proportional to the distance from the level sensor to the liquid level, the Model 3210 flow meter could calculate the distance from the level sensor to the liquid level. Once the depth of flow was input into the flow meter, any changes in liquid level were converted into changes in depth of flow and recorded by the flow meter.

a. Open Channel Flow Theory

The level data recorded by the ISCO 3210 flow meters was converted into approximate flow rates using open channel flow theory and Manning's equation for a partially full circular pipe of known diameter. Open channel flow theory and Manning's equation assume that the flow regime within a sewer is uniform and steady.

The flow regime in a sewer is neither uniform nor steady with time. However, it is assumed that the flow is uniform and steady during a two minute interval between depth measurements. Under these assumptions, the flow rate is dependent on two parameters: depth of flow and the slope of the energy grade line.

The depth of flow is measured accurately by the ISCO 3210 flow meter, but, the slope of the energy grade line depends on several independent variables. These variables change with each discrete flow regime and can not be measured. Therefore, an approximate method must be used to obtain the slope of the energy grade line that relied on estimated flow rates at specific locations.

b. Calibration Technique

The slope of the energy grade line for each metered manhole was approximated using a relationship between the velocity and the depth of the flow. This relationship was unique to each manhole and required the simultaneous measurement of velocity and depth over time. This was accomplished by using an ISCO 4150 flow logger for a brief metering period. Once a relationship between the velocity and the depth of flow in a manhole was determined, the slope of the energy grade was approximated using Manning's equation for a partially full circular pipe of known diameter.

7. ISCO 4150 Flow Logger Theory

ISCO 4150 flow loggers measure the depth of flow with a pressure transducer and the velocity of flow with a doppler sensor. The rate of flow of a fluid is dependent on the flow area and the velocity of the flow. The flow area was computed based on the depth of flow and the geometry of the flow channel while the velocity was computed based on the doppler effect. Finally, the flow rate was computed at a user-defined interval based on the flow logger's computation of flow area and velocity.

8. Monitoring Program

The intent of the Flow Monitoring Program, the subsystem evaluation, the microsystem evaluation and the outside system users evaluation was:

- to determine if wastewater flows within the Town of Griffith's sewer system are excessive.
- to establish a correlation between rainfall events, groundwater table elevations and wastewater flow rates.
- to isolate particular subsystems that may be the cause of the excessive loading.
- to locate point sources of inflow, infiltration or rainfall-induced infiltration.
- to determine the effect of outside system users on the Town of Griffith's sewer system.

Rainfall events, groundwater table elevations and wastewater flow rates were monitored simultaneously to fulfill the above objectives. Information concerning subsystems, microsystems and outside system users is summarized in Metering Site Summary sheets. Besides summarizing the field information, the Metering Site Summary Sheets aided in the analysis of the flow conditions.

9. Metering Site Summary Sheet Description

The following is an explanation of the flow metering site summary sheets that appear in Appendix (I). Figure 2 is an example of a typical metering site summary. Each summary sheet, column number and heading are listed below along with a brief description.

a. COLUMN 1 - Date

The date that the data was recorded.

b. COLUMN 2 - Weekday

The day of the week upon which the data recording occurred.

c. COLUMN 3 - Total Volume (gal)

The total volume of water that passed the referenced metering site on a specified date (after calibration).

d. COLUMN 4 - Maximum Flow Rate (mgd)

The maximum instantaneous flow rate recorded at the referenced metering site on a specified date (after calibration).

e. COLUMN 5 - Minimum Flow Rate (mgd)

The minimum instantaneous flow rate recorded at the referenced metering site on a specified date (after calibration).

f. COLUMN 6 - Rainfall (in)

The amount of rainfall recorded at the Cline Avenue Pump Station for a specified date.

g. COLUMN 7 - Wet or Dry Weather

Days were classified as wet or dry on the basis of rainfall. If a rainfall event occurred on a given day above one-tenth of an inch, the day was considered wet. Days that were not classified as wet were designated as dry weather days.

FIGURE 2

Town of Griffith, Indiana

Metering Summary - Manhole I-03
April 7, 1995 to April 27, 1995

Location: On Pine St.; west of Wiggs Ave.; south of Danrick Apts.

Bedtime Population: 1,228 People
Invert Elevation: 607.00 ft
Pipe Diameter: 2.25 ft
EGL Slope: 0.00034 ft/ft
Mannings "n": 0.0130

Avg Dry Weather Flow (Q): 462,299 gpd
Avg Daily Water Usage (U):
Average = 135,263 gpd

EPA Allowable Flows:
Dry Weather (120 gpcd) = 147,360 gpd
Wet Weather (275 gpcd) = 337,700 gpd

(3)-

(1) Date	(2) Weekday	(3) Total Volume (gal)	(4) Maximum Flow (mgd)	(5) Minimum Flow (mgd)	(6) Rainfall (in)	(7) Wet or Dry Weather	(8) Total Flow Per Capita (gpcd)	(9) Estimated Inflow (gal)	(10) Groundwater Elevation (ft)	(11) Average Depth of Water in MH (ft)	(12) Average Flow Elevation (ft)	(13) Head Differential (ft)	(14) Estimated Infiltration (gal)
7-Apr	Friday	365,628	0.57	0.20	0.00	dry	298	0	615.93	0.40	607.40	8.54	230,365
8-Apr	Saturday	397,358	0.59	0.22	1.10	wet	324	0	616.11	0.41	607.41	8.70	262,095
9-Apr	Sunday	425,100	0.74	0.21	1.10	wet	346	0	616.29	0.43	607.43	8.86	289,837
10-Apr	Monday	434,279	0.79	0.23	0.20	wet	354	0	616.46	0.43	607.43	9.03	299,016
11-Apr	Tuesday	444,498	0.68	0.26	1.00	wet	362	0	616.64	0.44	607.44	9.20	309,235
12-Apr	Wednesday	473,212	0.63	0.30	0.20	wet	385	10,913	617.07	0.45	607.45	9.62	327,036
13-Apr	Thursday	473,979	0.68	0.31	0.00	wet	386	11,680	616.98	0.45	607.45	9.52	327,036
14-Apr	Friday	482,395	0.65	0.30	0.00	dry	393	0	616.88	0.46	607.46	9.43	347,132
15-Apr	Saturday	484,076	0.66	0.29	0.00	dry	394	0	616.79	0.46	607.46	9.33	348,814
16-Apr	Sunday	468,687	0.65	0.27	0.00	dry	382	6,388	616.69	0.45	607.45	9.24	327,036
17-Apr	Monday	475,930	0.67	0.28	0.70	wet	388	13,631	616.60	0.45	607.45	9.14	327,036
18-Apr	Tuesday	479,875	0.67	0.29	0.00	wet	391	17,576	616.50	0.46	607.46	9.05	327,036
19-Apr	Wednesday	464,406	0.62	0.29	0.20	wet	378	2,108	616.41	0.45	607.45	8.96	327,036
20-Apr	Thursday	461,081	0.63	0.28	0.10	wet	375	0	616.31	0.45	607.45	8.87	325,818
21-Apr	Friday	456,737	0.63	0.28	0.00	wet	372	0	616.22	0.44	607.44	8.77	321,475
22-Apr	Saturday	479,021	0.64	0.27	0.00	dry	390	0	616.12	0.45	607.45	8.67	343,759
23-Apr	Sunday	493,985	0.67	0.28	0.00	dry	402	31,686	616.03	0.46	607.46	8.57	327,036
24-Apr	Monday	410,858	0.67	0.26	0.20	wet	335	0	615.93	0.42	607.42	8.51	275,595
25-Apr	Tuesday	369,709	0.56	0.16	0.00	wet	301	0	615.94	0.40	607.40	8.54	234,446
26-Apr	Wednesday	370,986	0.58	0.18	1.00	wet	302	0	615.95	0.40	607.40	8.55	235,723
27-Apr	Thursday	385,238	0.60	0.20	0.00	wet	314	0	615.96	0.41	607.41	8.55	249,975

Town personnel recorded rainfall data for a given day on the morning of the following day. Given this procedure, the day following a rain event may also be considered wet, if accompanied by a substantial increase in total volume. In the case of some unusually heavy rainfall events, the impact on the system may be noticeable for some additional days after that event. In these cases, engineering judgment was used to determine if it was a wet or dry day.

Considering the above designation, the Average Dry Weather Flow (Q) was computed for each given metering period. As implied, the Average Dry Weather Flow was calculated by averaging the daily total volumes for all dry weather days.

h. COLUMN 8 - Total Flow Per Capita (gpcd)

The total flow per capita was computed by dividing the total volume of flow by the population contributing wastewater to that flow. This value was used for comparison with the recommended flow rates of 120 gallons per capita per day of domestic flow and non-excessive I/I on a dry weather day and 275 gallons per capita per day on a wet weather day.

Total Flow Per Capita = Total Volume ÷ Contributing Population

Column (8) = Column (3) ÷ Contributing Population

i. COLUMN 9 - Estimated Inflow (gal)

Inflow was computed for only wet weather days. The following was used to calculate inflow:

Estimated Inflow = Total Volume - Average Dry Weather Flow

Column (8) = Column (3) - (Q)

j. COLUMN 10 - Groundwater Elevation (ft)

For each metering location, the groundwater elevations were estimated from the contour map of the average groundwater isoclines that was generated from piezometric data in the Town of Griffith. For a given metering site, an average groundwater elevation was determined by interpolating between adjacent groundwater contours. The differential between this value and average groundwater elevation at the closest groundwater gage was then determined. Assuming a consistent differential throughout the metering period, groundwater elevations were calculated for a metering site by adding the differential to the recorded groundwater elevation for the closest gage. Groundwater elevations were linearly interpolated between recording dates to fill gaps in data.

k. COLUMN 11 - Average Depth of Water in Manhole (ft)

The average of the wastewater depths recorded by the ISCO flow meters.

l. COLUMN 12 - Average Flow Elevation (ft)

The sum of the invert elevation and the average depth of wastewater flow at a given metering site.

Average Flow Elevation = Invert Elevation + Average Depth of Water in Manhole

Column (12) = Invert Elevation + Column (11)

m. COLUMN 13 - Head Differential (ft)

The difference between the groundwater elevation and the average flow elevation.

Head Differential = Groundwater Elevation - Average Flow Elevation

Column (13) = Column (10) - Column (12)

A positive value indicated that groundwater was above the surface of the flowing wastewater; thus, infiltration was possible. A negative value indicated that groundwater was below the surface of the flowing wastewater; consequently, there was no possibility of infiltration.

n. COLUMN 14 - Estimated Infiltration (gal)

Infiltration was computed only on days that had a positive head differential. There were two cases for which infiltration could occur; one where inflow simultaneously occurred and the other, where no inflow occurred.

For both cases, the Average Monthly Water Usage (U) was required. This value was individually computed for each metering site based on the demographics of the contributing area and the water usage billing records for the Town of Griffith. For a more detailed discussion, see the section on Water Usage.

In the first case, infiltration was estimated by taking the difference of the average dry weather flow and the average water usage. By its nature, this was a fixed value regardless of the date it occurred; but, it was judged to be the best approximation for the scenario.

Estimated Infiltration = Average Dry Weather Flow - Average Water Usage

Column (14) = (Q) - (U)

In the second case, infiltration was computed by taking the difference of the total volume of wastewater flow date and the average daily water usage.

Estimated Infiltration = Total Volume - Average Water Usage

Column (14) = Column (3) - (U)

V. REMEDIAL ACTION

A. WORK PERFORMED

The Town of Griffith has undertaken several projects over the last several years to improve the overall condition and operation of their sewer system. These projects are described below.

1. Submersible Pumps

Two submersible pumps were installed in the Cline Avenue Pump Station wet well and have been completely operational since December 15, 1993. The pumps were installed to provide a backup system for the existing pumps.

The two submersible pumps are capable of pumping approximately 5.5 MGD when operating together versus a capacity of approximately 4.3 MGD with the existing pumps.

2. Sewer Meter

A new Polysonics Model MST ultrasonic flowmeter was installed in a metering manhole downstream of the Cline Avenue Pump Station in April, 1995.

3. Industrial Surveys

During March and April of 1994, the Town compiled a list of industries that discharge process wastewater into the Griffith sewer system. The industries were required to complete and return an industrial survey questionnaire form which included the following information:

- the manufacturing process
- the description of the manufactured products
- the type of raw materials and chemicals used
- the discharge sources into the Griffith sewer system
- the flow frequency
- the analysis of the characteristics of the wastewater discharged to the Griffith sewer system and others.

Approximately 166 questionnaires have been returned. The Town will use the information to take the necessary action to prevent discharges into the sewer system which may adversely affect its operation.

4. Flow Meters & Samplers

The Town purchased two ISCO Portable Samplers and two ISCO 4150 Flow Logger Velocity Meters for monitoring problem industries with suspect discharges, insuring conformance with the Town's Sewer Use Ordinance and checking sewer flows as part of an Annual Maintenance Program. The velocity meters were used extensively throughout the SSES.

5. Sewer Use and Sewer Rate Ordinance

The Town prepared and sent a revised Sewer Use and Sewer Rate Ordinance to the Environmental Protection Agency and the Indiana Department of Environmental Management for their review and comments on July 1, 1994. The Sewer Rate Ordinance has been enacted.

Appendix R includes copies of:

a. The Sewer Rate Ordinance presently in effect.

b. The current Sewer Use Ordinance.

c. The proposed Sewer Use Ordinance.

d. A side-by-side comparison of the Town of Griffith Sewer Use Ordinance with the Hammond Sanitary District Sewer Use Ordinance and Pretreatment Ordinance.

6. System Maintenance

a. Manhole Repair

While performing field work related to the SSES, numerous manholes were opened and inspected throughout the Town of Griffith. A list was made of those manholes which exhibited signs of infiltration in varying stages of severity. It was decided to repair these manholes to reduce the overall infiltration and inflow into the sewer system.

In November of 1994, quotations were solicited from three Contractors in the area to correct problem manholes found up to that date. Contracts were awarded to Gatlin Plumbing & Heating for the repair of twenty-three (23) manholes and M.S. Enterprises for the repair of four (4) manholes. A summary of the manhole repair project and a copy of the proposals for these two Contractors is included in Appendix M.

With the exception of Manhole 17, this work has been substantially completed. Repairs varied by manhole and included cleaning, joint repair, waterproofing, installing new cone and ring sections, height adjustments, grouting, etc. Due to access problems, Manhole 17 will be repaired at a later date. Additional manhole repair projects will be recommended in Section V, Remedial Action.

b. Sewer Cleaning and Television Inspection

In March of 1995, several areas in the Town of Griffith sewer system were televised by R & R Sewer. The areas chosen were based on field inspections, metering analyses and locations within the system.

Sewer lines underneath the Cady Marsh Ditch were included since problems with these lines would result in high infiltration. Sections of the interceptor were to be televised, however this work has been delayed due to accessibility problems. Other areas listed to be televised were near large industries or in locations where the metering results indicated potential infiltration. See Appendix N for:

- A summary of the lines awaiting televising.
- A summary of the televised lines.
- The R & R Sewer proposal.
- The R & R Visual inspection logs for the televised lines.

Further discussion of the televising performed in each subsystem can be found in Section V, Subsection (B).

c. Landfill Leachate Pumping and Sediment Control

Various amounts of sediment were discovered in the southernmost section of the sewage interceptor in the Town of Griffith. Various quantities of sediment were encountered during manhole inspections beginning at Interceptor Manhole 60 and continuing through Interceptor Manhole 77.

One possible source of the sediment deposition was the pumping of leachate and runoff from the Town of Griffith Landfill. This was verified during a field investigation performed on September 29, 1994. The Town immediately began work on a project to trap the grit and prevent any further buildup in the interceptor sewer.

A grit chamber was installed in early 1995. The leachate is pumped into the chamber which acts as a sedimentation basin. The liquid then flows by gravity through a 6 inch cast iron line into Manhole 70.

Bids have been received by the Town to clean the interceptor sewer from Manhole 60 to 80. Additional information on this project can be found in Section V, Subsection (C), Part (1).

B. SYSTEM ANALYSES AND RECOMMENDATIONS

General Discussion

The system analyses and subsequent recommendations are based on the observations of numerous field surveys and the results of the flow monitoring program. Each subsystem has been analyzed for its response to wet and dry weather. Subsystem flows and inflow and infiltration totals may be found in Table No. 1.

Based on the severity of inflow and infiltration, each subsystem has been categorized as either a Phase I, II or III remedial action. Subsystems with inflow or infiltration rates in excess of 100,000 gpd are classified as a Phase I remedial action. Phase I remedial work includes cleaning and televising trunk and collector lines, repairing certain manholes with obvious I/I sources and initiating the removal of improper connections. Subsystems with inflow or infiltration rates between 10,000 and 100,000 gpd have been classified as requiring Phase II remedial action. Phase II work includes cleaning and televising major trunk lines and further microsystem monitoring to identify I/I sources. All other subsystems have been classified as Phase III. Aside from continued monitoring and maintenance, no remedial work has been recommended.

It should be noted that the following analyses and recommendations are based on work completed to date. Further field investigations are necessary to isolate I/I sources in many instances.

1. Subsystem A

Subsystem A, located in the extreme northwest section of Town, is bordered to the north by River Drive, to the south by Ridge Road, to the east by the E. J. & E. Railroad and to the west by Cline Avenue. This subsystem was metered at three locations to determine the total contribution to the Town's sewage flow. The three sites were Manhole A-08 which isolated the industrial park on Woodlawn Avenue, Manhole A-14 which isolated the entire south side of Subsystem A and Manhole A-11 which isolated the south side of Subsystem A in peak flow periods. (See Figure 3 for the exact subsystem location.)

Upon initial review of the metering data available, it would appear that the dry weather flows and the wet weather flows could be considered excessive. However, Subsystem A contains a heavy concentration of industrial and commercial businesses that the EPA flow criteria did not consider. Thus, based on the billed water usage and the metering results from Subsystem A, only minor amounts of infiltration and inflow occurred. Furthermore, the metering results and television inspection revealed that the majority of the infiltration problems are attributed to leaking joints and broken tiles in the industrial park located on Woodlawn Avenue. Subsystem A has been classified as a Phase II infiltration area and a Phase III inflow area.

Field inspections at Manholes A-10 and A-49 showed leaks through the joints and no poured invert, respectively. (Infiltration could enter the system by seeping through the bottom in Manhole A-49.)

Gatlin Plumbing & Heating, Inc. has repaired the leaks in Manhole A-10. No work has been performed on Manhole A-49. It is recommended that a concrete invert be placed in Manhole A-49 as part of Phase I remedial work. Additionally, R & R Sewer has cleaned, televised and videotaped the sewer from Manhole A-4 to the interceptor Manhole 11.

Approximately 2,580 linear feet of sewer line should be cleaned and televised as part of Phase II remedial work.

2. Subsystem B

Subsystem B, located in the northeast section of Town, is bordered to the north by River Drive, to the east by Colfax Street and to the west by the E. J. & E. Railroad. Its southern edge loosely follows Ridge Road. The flows in Subsystem B were isolated by metering in Manhole B-01. (See Figure 3 for the exact subsystem location.)

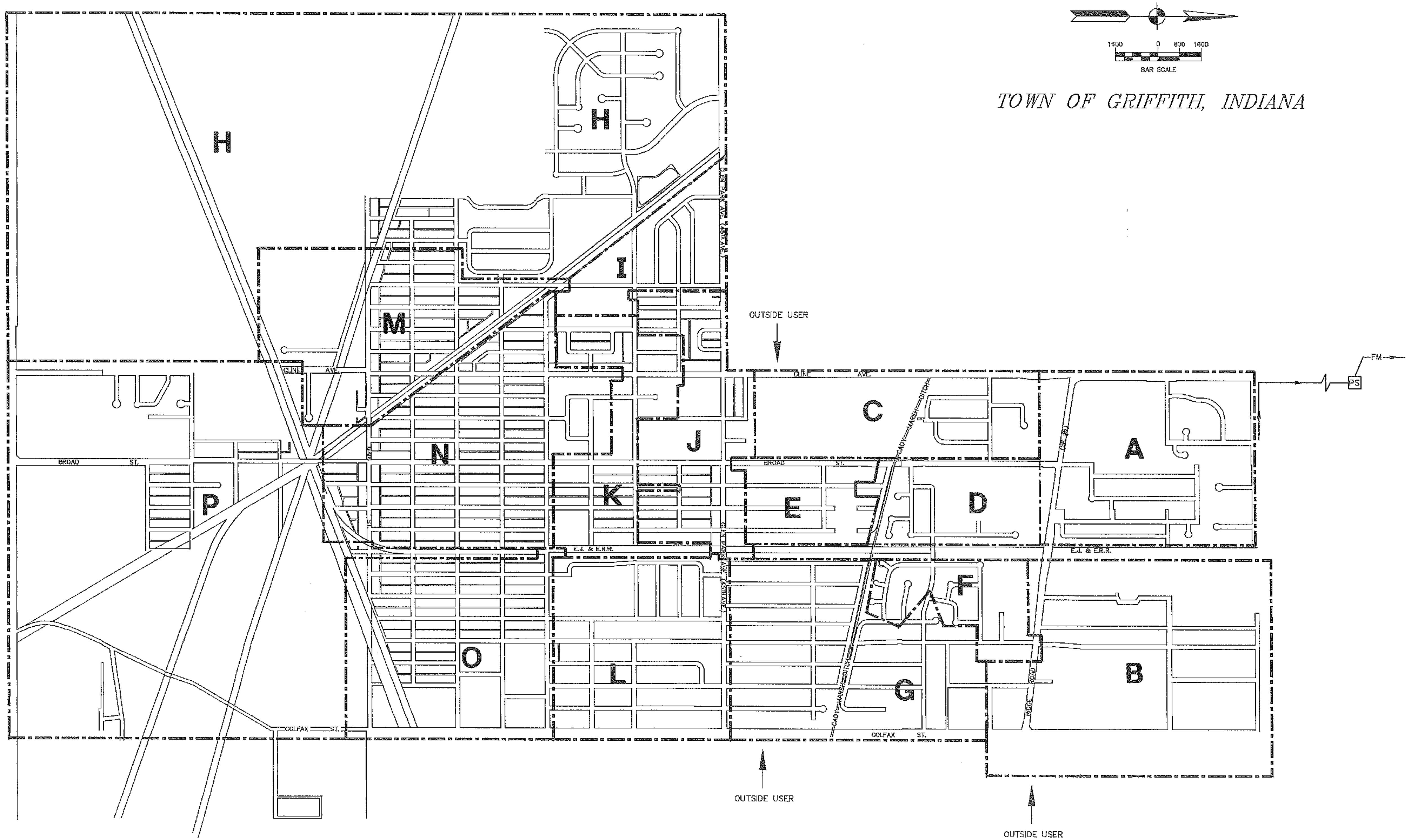
TABLE 1

Town of Griffith, Indiana

Remedial Action Plan - Inflow and Infiltration Study

I/I Totals and Remedial Action Phases

Subsystem	Average Daily Flow (mgd)	Theoretical Wastewater Production Rate (mgd)	Average Dry Weather Flow (mgd)	EPA 120 gpcd Allowable Dry Weather Flow (mgd)	Estimated Infiltration (mgd)	Average Wet Weather Flow (mgd)	EPA 275 gpcd Allowable Wet Weather Flow (mgd)	Estimated Inflow (mgd)
A	0.158	0.078	0.161	0.067	0.083	0.156	0.153	0.000
B	0.198	0.256	0.200	0.470	0.000	0.193	1.076	0.000
C	0.066	0.044	0.073	0.041	0.029	0.061	0.094	0.000
D	0.119	0.051	0.113	0.046	0.062	0.128	0.105	0.015
E	0.102	0.044	0.103	0.052	0.059	0.101	0.118	0.000
F	0.118	0.057	0.115	0.064	0.058	0.100	0.146	0.000
G	0.217	0.151	0.216	0.181	0.065	0.217	0.414	0.001
H	0.422	0.135	0.415	0.147	0.280	0.427	0.338	0.012
I	0.790	0.058	0.713	0.079	0.655	0.849	0.180	0.136
J	0.068	0.090	0.068	0.106	0.000	0.330	0.244	0.262
K	0.481	0.063	0.782	0.055	0.719	0.331	0.125	0.000
L	0.604	0.162	0.599	0.221	0.437	0.619	0.506	0.020
M	0.585	0.635	0.578	0.075	0.000	0.597	0.172	0.019
N	0.189	0.240	0.186	0.192	0.000	0.191	0.441	0.005
O	0.224	0.198	0.201	0.140	0.003	0.237	0.321	0.036
P	0.301	0.095	0.332	0.063	0.237	0.277	0.145	0.000



TOWN OF GRIFFITH, INDIANA
REMEDIAL ACTION PLAN
SEWER SYSTEM EVALUATION SURVEY
(SSES)

SUBSYSTEMS

LAWSON-FISHER ASSOCIATES
CONSULTING ENGINEERS
525 W. WASHINGTON
SOUTH BEND, INDIANA 46601
PH. (219) 234-3167

FIGURE 3

93011.10

FILE: 93011/TOWNSUB
DRAWN BY: HD BROWN
CHECKED BY: DAZ
DATE: MARCH 1996
FIELD BOOK: NONE

The dry weather flows and the wet weather flows in Subsystem B were below EPA's allowable flow criteria. The average dry weather flow of 200,000 gallons per day was below the theoretical wastewater production rate. In addition, there was no response to rainfall events. Therefore, Subsystem B was classified a Phase III infiltration and inflow area.

The following observations have been made from field investigations:

- Subsystem surcharges have been observed during high rainfall events. This may indicate inflow problems.
- Clear flow has been observed in Manhole B-02.
- Areas of ponding have been observed.

It is important to note the following outside user connections:

- Black Oak Elementary School has force main discharge in Manhole B-05.
- Midstates Distributors, Ross Church and Lake Ridge Middle School has force main discharge in Manhole B-05f.
- Calumet High School gravity sewer connection in Manhole B-08.

It is recommended that flow from all outside users be monitored. This would provide a more accurate volume of flow from the outside users. It is also recommended that repairs to Manhole B-02 be performed as part of Phase I remedial work and that repairs to Manhole B-07 be included in Phase II remedial work.

3. Subsystem C

Subsystem C, located in the northwest section of Town, is bordered to the north by Ridge Road, to the south by 44th Street, to the east by Broad Street and to the west by Cline Avenue. The wastewater flow from Subsystem C was isolated by metering in Manhole C-05. (See Figure 3 for the exact subsystem location.)

The average dry weather flow was excessive. However, the average wet weather flow was below the EPA Allowable Wet Weather Flow by 30,000 gallons per day. Based on the metering results and the theoretical wastewater production rate, Subsystem C was found to have a minor infiltration problem and no inflow problem. Therefore, Subsystem C has been classified as a Phase II infiltration area and a Phase III inflow area.

Field inspections have observed an outside connection from Strack & Van Til.

R & R Sewer has cleaned, televised and videotaped the sewer from Manhole C-03 to C-04.

It is recommended that Manhole C-2 be repaired as part of Phase I remedial work. Approximately 1,600 lineal feet of sewer line should be cleaned and televised as part of Phase II remedial work.

4. Subsystem D

Subsystem D, located in the north central section of Town, is bordered to the north by Ridge Road, to the south by Brinwood Drive, to the east by Broad Street and to the west by the E. J. & E. Railroad. The wastewater flow from Subsystem D was isolated by metering in Manhole D-01 and subtracting the flow contributing to Subsystem D from Subsystem C and Subsystem E at Manholes C-05 and E-02, respectively. (See Figure 3 for the exact subsystem location.)

Upon initial review of the metering data available, the average dry weather flow and the average wet weather flow appear to be excessive. However, Subsystem D's water usage was much higher than the 80 gallons per capita per day assumed by the EPA. Thus, based on metering results and the theoretical wastewater production rate, Subsystem D has a minor infiltration and inflow problem. The average dry weather flow revealed 62,000 gallons per day of infiltration, while the average wet weather flow revealed 14,000 gallons per day of inflow. Therefore, Subsystem D has been classified a Phase II infiltration and inflow area.

A field inspection of Manhole D-01 revealed leaks through the barrel joints.

R & R Sewer has cleaned, televised and videotaped the sewer from Manhole D-05 to D-06. Work performed by Gatlin Plumbing & Heating, Inc. grout sealed all leaky joints in Manhole D-01.

It is recommended that approximately 1,600 lineal feet of sewer line be cleaned and televised as part of Phase II remedial work.

5. Subsystem E

Subsystem E, located in the north central section of Town, is bordered to the north by Brinwood Drive, to the south by 45th Avenue, to the east by Broad Street and to the west by the E. J. & E. Railroad. The wastewater flow from Subsystem E was isolated by metering in Manhole E-02. (See Figure 3 for the exact subsystem location).

The average dry weather flow in Subsystem E was excessive, while the average wet weather flow was not. Based on the metering results, the theoretical wastewater production rate and the hydrogeological information, it is evident that Subsystem E has a Phase II infiltration problem and a Phase III inflow problem.

Field inspections revealed excessive sediment in the sewer line on Broad Street. Cleaning, televising and videotaping of this sewer line was performed by Rex Construction. The work revealed excessive amounts of granular-type sediment and aggregate. Large amounts of granular aggregate indicates a potential infiltration problem.

It is recommended that approximately 1,350 lineal feet of sewer line be cleaned and televised as part of Phase II remedial work.

6. Subsystem F

Subsystem F, located in the north central section of Town, is bordered to the north by Ridge Road, to the south by the Cady Marsh Ditch and to the west by the E.J. & E. Railroad. (There is no particular boundary to the east.) The wastewater flow from Subsystem F was isolated by metering in Manhole F-01. (See Figure 3 for the exact subsystem location.)

Average dry weather and wet weather flows for Subsystem F were below EPA's flow criteria. Based on the metering results, the theoretical wastewater production rate and the hydrogeological data, it appears that Subsystem F has a minor infiltration problem and no inflow problem. Therefore, Subsystem F has been classified a Phase II infiltration area and a Phase III inflow area.

Field investigations revealed several sewer lines filled with sediment that could impede sewage flow. An inspection of Manhole F-03 showed no poured invert allowing infiltration to enter the system by seeping through the manhole bottom.

It is recommended that a concrete invert be placed in Manhole F-03 to prevent groundwater from infiltrating into the system as part of Phase II remedial work. It is also recommended that repairs to Manhole F-04 as well as the cleaning and televising of approximately 4,820 lineal feet of sewer line be completed as part of Phase II remedial work.

7. Subsystem G

Subsystem G, located in the northeast section of Town, is bordered to the north by Subsystem F and 39th Place, to the south by 45th Avenue, to the east by Colfax Street and to the west by the E. J. & E. Railroad. The wastewater flow from Subsystem G was isolated by metering Manhole 37. (See Figure 3 for the exact subsystem location.)

The average dry weather flow was excessive, while the average wet weather flow was not. Based on the metering results, the theoretical wastewater production rate and the hydrogeological data, it is evident that Subsystem G responds to groundwater conditions, however, does not respond to rainfall. Therefore, Subsystem G has been classified as a Phase II infiltration area and a Phase III inflow area.

Field investigations revealed several sewer lines filled with sediment that could impede flow. Flow metering was prevented by sediment in Manholes G-23, G-24, G-61, G-91 and G-99. It was noted that sediment in this subsystem was predominately granular material. This is indicative of groundwater infiltration into the sewer.

A manhole inspection at G-81, a storm manhole, revealed storm water was entering the system via a drilled hole in the line that runs through G-81. Additional manhole inspections at G-15, G-16 and G-17 revealed infiltration through the barrel joints.

Work to repair the infiltration in Manholes G-15, G-16, & G-17 was completed by Gatlin Plumbing & Heating, Inc. Additionally, R & R Sewer has cleaned, televised and videotaped the sewer from Manhole G-1 to G-8.

It should be noted that Longfellow Elementary School, an outside user, contributes wastewater flow to Subsystem G at Manhole Long-05.

It is recommended that Manhole Long-4 be repaired as part of Phase I remedial work and that Manholes Long-2 and Long-3 be completed as part of Phase II remedial work. The hole in Manhole G-81 should be plugged as part of Phase I remedial work.

It is also recommended that repairs to Manholes G-23, G-24, G-61, G-91 and G-99 be completed as well as cleaning and televising of approximately 5,498 lineal feet of sewer line as part of Phase II remedial work.

8. Subsystem H

Subsystem H, located in the southwest section of Town, is bordered to the north by 45th Avenue, to the south by Avenue H, to the west by the Town's political boundary with Highland and to the east by Subsystems I, M and P. The wastewater flow from Subsystem H was isolated by metering in Manhole I-03. (See Figure 3 for the exact subsystem location.)

The average dry and wet weather flows in Subsystem H were excessive. Based on the metering results, the theoretical wastewater production rate and hydrogeological data, it appears that Subsystem H responds to high groundwater conditions and rainfall events. Subsystem H flow data revealed approximately 300,000 gallons per day of infiltration. In addition, rainfall events increased the immediate amount of flow through the subsystem and increased flows throughout the system even after the event. Therefore, Subsystem H has been classified as a Phase I infiltration area and as a Phase II inflow area.

Field inspections showed that Manholes H-03 & H-04 had water infiltrating through the joints. Inspections along Evergreen Lane, an abandoned street in a wetland, revealed clear flow in the sewer line. Additional investigations on Evergreen were prevented by flooding of the wetland.

Also, field inspections of the 27" trunk on Lillian Avenue and Pine Street indicated an excessive sediment loading in the sewer lines.

Since the sewers in Subsystem H were relatively new, a majority of the extraneous flow could be attributed to sump pump connections. Additional infiltration could also be from drainage from the wetland. * (Recall that flooding from the wetland prevented a thorough field investigation of Evergreen Lane.)

The following is recommended:

- Plug all lines from the wetland as part of Phase I remedial work.
- Inspect residential neighborhoods for sump pump connections.
- Smoke test for sump pump connections.
- Clean, televise and videotape the line in Lillian Avenue.
- Clean, televise and videotape the line in Pine Street.
- Inspect Evergreen Lane for infiltration.
- Clean and televise approximately 30,010 lineal feet of sewer line as part of Phase I remedial work.
- Repair Manholes number H-01, H-03 and H-04 as part of Phase II remedial work.

9. Subsystem I

Subsystem I, located in the southwest section of Town, is bordered to the north by 45th Avenue and Pine Street, to the south by Elm Street, to the west by the abandoned Erie Railroad easement and to the east by Wiggs Street and Raymond Street. The wastewater flow from Subsystem I was isolated by metering in Manhole I-01 and subtracting wastewater flow contributing to Subsystem I from Subsystems H and M at Manholes I-03 and M-03, respectively. (See Figure 3 for the exact subsystem locations.)

The average dry and wet weather flows were excessive. Based on the metering results, the theoretical wastewater production rate and hydrogeological data, it appears that Subsystem I has infiltration and inflow problems. The average dry weather flow exceeded the theoretical wastewater production rate by as much as 560,000 gallons per day. Average rainfall events increased the amount of daily flow by 230,000 gallons. Therefore Subsystem I has been classified as a Phase I infiltration and inflow area.

Field investigations revealed that the 30" trunk on Pine Street contained 6" to 12" of sediment. Sediment was comprised of granular material. This is indicative of infiltration. A manhole inspection at I-02 showed infiltration at the joint between the access tube and the barrel.

Repair work to Manhole I-02 was completed by M S Enterprises. (This manhole was used to demonstrate the repair method used by M S Enterprises.)

It is recommended that approximately 7,320 lineal feet of sewer line be cleaned and televised as part of Phase I remedial work.

10. Subsystem J

Subsystem J, located in the southwest section of Town, is bordered to the north primarily by 45th Avenue, to the south primarily by Pine Street, to the east by the E. J. & E. Railroad and to the west by Ash Street. The wastewater flow from Subsystem J was isolated by metering in Manhole 44. (See Figure 3 for the exact subsystem location.)

Based on the metering results, the theoretical wastewater production rate and hydrogeological data, it is evident that Subsystem J does not exhibit an infiltration problem. However, metering within subsystem J isolated an inflow problem in the eastern section of the subsystem. Rainfall events cause an average increase of approximately 260,000 gallons per day. Therefore, Subsystem J has been classified as a Phase III infiltration area and a Phase I inflow area.

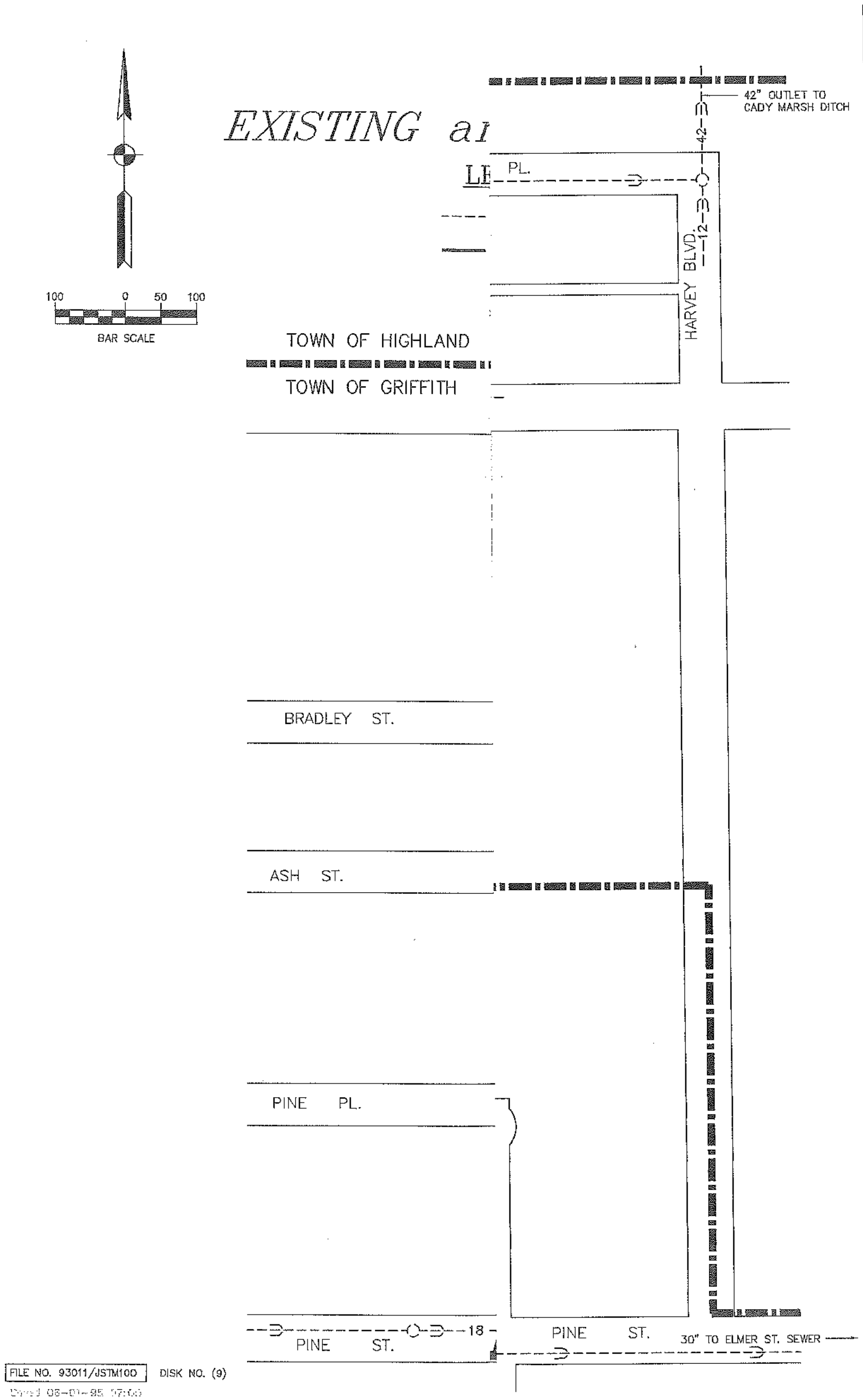
Field investigations revealed the following sources of inflow.

- Storm inlets drained into Manholes J-14a and J-16a.
- Drilled holes in manhole lids at J-13a, J-49a, J-54, J-55, J-58, & J-60. Each lid was located in a poorly drained, flood prone area.
- Damaged manhole structures at J-19 & J-55.
- Open keyed manhole lids.

Storm inlets, lids with drilled holes and damaged manhole structures are the major inflow sources. The following is recommended:

- Provide new storm sewer lines to alleviate flooding in the following areas as part of Phase I remedial work: (See Figure 4.)

    Glen Park Avenue from Ernest Avenue to Cline Avenue.
    Woodside Drive West
    Woodside Drive East



TOWN OF GRIFFITH, INDIANA
REMEDIAL ACTION PLAN
SEWER SYSTEM EVALUATION SURVEY
(SSES)

SUBSYSTEM "J"
EXISTING AND PROPOSED STORM SEWERS

LAWSON-FISHER
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525 W. WASHINGTON
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FIGURE
4

93011.10

FILE: 93011/JSTM100
DRAWN BY: HD BROWN
CHECKED BY: DAZ
DATE: MARCH 1995
FIELD BOOK: NONE

Alleys between Ernest Avenue and Cline Avenue
Alley between Ernest Avenue and Raymond Avenue

- Disconnect the storm inlets from Manhole J-14a and reconnect them to the new storm sewer on Woodside Drive West.

- Disconnect the storm inlets from Manhole J-16a and reconnect the inlets to the new storm sewer on Glen Park Avenue.

- Install additional storm sewer inlets to alleviate flooding in the following intersections:

  Glen Park Street and Ernest Avenue
  Ash Street and Wiggs Avenue
  Ash Street and Ernest Avenue
  Ash Street and Raymond Avenue
  Ash Street and Lindberg Avenue
  Pine Street and Wiggs Avenue
  Pine Street and Ernest Avenue
  Pine Street and Raymond Avenue
  Pine Street and Lindberg Avenue

- Provide a cross-connection between the existing storm sewers at the intersection of Cline Avenue and 45th Place.

- Replace all manhole lids that have drilled holes with solid, gasket sealed lids.

- Realign and attach the casting on Manhole J-19.

- Repair the collapsed structure in Manhole J-55.

- Grout seal all joints in Manholes J-07, J-11, & J-12a.

- Clean all debris from Manholes J-16a and J-54.

11. Subsystem K

Subsystem K, located in the southwest section of Town, is bordered to the north primarily by Pine Street, to the south by Elm Street, to the east by the E. J. & E. Railroad and to the west by Raymond Avenue. The following steps were used to calculate the wastewater flow from Subsystem K.

- STEP 1 - Determine the total outflow from Subsystem K by metering in Manhole K-01
- STEP 2 - From the total outflow, subtract the inflow from Subsystems I, H and M at Manhole I-01.

- STEP 3 - From the flow in step 2, subtract the inflow from Subsystem N at Manhole N-02.

The average dry weather flow and wet weather flows were excessive. Based on the metering results, the theoretical wastewater production rate and hydrogeological data, it appears that Subsystem K has an infiltration problem with approximately 700,000 gallons per day; however, the metering results were inconclusive regarding inflow. Therefore, Subsystem K was classified as a Phase I infiltration area and a Phase III inflow area.

Field investigations revealed leaky joints in Manhole K-01 and storm inlets draining into the Manhole at K-42.

Work performed by Gatlin Plumbing & Heating, Inc. grout sealed all leaky joints in Manhole K-01. It is recommended that the storm inlets be disconnected from K-42 and reconnect to the new storm line. As in Subsystem I, the sewer line on Pine Street should be cleaned, televised and videotaped.

It is recommended that Manholes K-35, K-38, K-39, K-41, K-42 and K-43 be repaired and approximately 14,655 lineal feet of sewer line be cleaned and televised as part of Phase I remedial work.

It is also recommended that Manholes K-4, K-7, K-11 and K-12 be repaired as part of Phase II remedial work.

12. Subsystem L

Subsystem L, located in the southeast section of Town, is bordered to the north by 45th Avenue, to the south by Elm Street, to the east by Colfax Street and to the west by the E. J. & E. Railroad. The wastewater flow from Subsystem J was isolated by metering in Manhole L-02. (See Figure 3 for the exact subsystem location.)

The average dry and wet weather flows were excessive. Based on the metering results, the theoretical wastewater production rate and the hydrogeological data, it appears that Subsystem L has an infiltration problem with approximately 440,000 gallons per day. It is evident that an average rain event causes an increase of approximately 20,000 gallons per day. Therefore, Subsystem L has been classified as a Phase I infiltration area and as a Phase II inflow area.

Field investigations revealed the following:

- Ten manholes with drilled holes in the lid. (Of the ten lids, nine are located in highly flood prone easements.)
- Damaged manhole structures at L-60, L-86 & L-87
- Leaky manhole joints at L-13, L-63, L-64, & L-71a

- Mineral deposits in Manholes L-58, L-76, L-83, & L-89a
- Several manholes filled with solids.
- Numerous manhole lids with open keys.

The primary source of excessive inflow was the manholes with the drilled holes in the lid. The following is recommended:

- Install new storm sewer lines to alleviate flooding in the easements border by Elmer Avenue and Jay Avenue in between the following streets:

  Glen Park Avenue and Ash Place.
  Ash Place and Ash Street
  Ash Street and Pine Place
  Pine Place and Pine Street
  Alley between Ernest Avenue and Raymond Avenue

- Install new storm sewer lines to alleviate flooding in the easements border by Jay Avenue and Arbogast Avenue in between Glen Park Street and Oak Street.

  Note: The Town should verify that flow from the new storm sewer will not be inhibited by the existing throttle in the diversion chamber at the intersection of Brinwood Street and Arbogast Avenue. A hydraulic study at the diversion chamber in Subsystem G is recommended. The results of the study will determine any necessary improvements at that location.

- Replace all manhole lids that have drilled holes with solid, gasket sealed lids.

  Note: Replacing the existing lids without providing storm water drainage could result in severe and expensive flood damage in residential areas.

- Realign and attach the casting on Manholes L-60, L-86, & L-87.

- Grout seal all joints in Manholes L-13, L-63, L-64, & L-71a.

- Remove all mineral deposits and repair all leaky spots in Manholes L-58, L-76, L-83, & L-89a.

- Clean all debris from the following manholes:
  - L-27
  - L-41
  - L-42
  - L-46
  - L-52
  - L-56
  - L-56a
  - L-56b
  - L-58
  - L-59
  - L-80
  - L-83
  - L-85
  - L-86
  - L-86a

It is believed that the manhole lids with open keys are a minor source of inflow. The recommendation is not to replace those lids.

The primary source of excessive inflow is due to inflow from the manholes with drilled holes in the lids.

It is recommended that Manholes L-60, L-86, L-87, L-13, L-58, L-63, L-64, L-71a, L-76, L-83 and L-89a be repaired and that approximately 21,220 linear feet of sewer line be cleaned and televised as part of Phase I remedial work.

It is also recommended that Manholes L-27, L-41, L-42, L-46, L-52, L-56, L-56A, L-56B, L-59, L-80, L-85 and L-86A be repaired and that the storm sewer project be implemented as part of Phase II remedial work

13. Subsystem M

Subsystem M, located in the southwest section of Town, is bordered to the north by the abandoned Erie Railroad easement, to the south by Industrial Drive, to the east by the abandoned Erie Railroad easement and to the west by Wiggs Avenue and True Avenue. The wastewater flow contributing to the sewer system from Subsystem M was isolated by metering in Manhole M-03.

Upon initial review of the metering data available, the average dry and wet weather flows appear to be excessive. However, Subsystem M contains a heavy concentration of industrial and commercial businesses that the EPA flow criteria did not consider. Based on the billed water usage and the metering results from Subsystem M, only a slight amount of inflow was evident. Therefore, Subsystem M was classified as a Phase III infiltration area and a Phase II inflow area.

R & R Sewer has cleaned, televised and videotaped the sewer from Manhole M-13 to M-16.

It is recommended that Manhole M-02 be repaired and that approximately 4,500 lineal feet of sewer line be cleaned and televised as part of Phase II remedial work.

14. Subsystem N

Subsystem N, located in the southwest section of Town, is bordered to the north Elm Street, to the south by E.J. & E. Railroad, to the east by E. J. & E. Railroad and to the west by the abandoned Erie Railroad easement. The wastewater flow from Subsystem N was isolated by metering in Manhole N-02. (See Figure 3 for the exact subsystem location.)

The average dry and wet weather flows in Subsystem N were below EPA's allowable flow criteria. Based on the metering results, the theoretical wastewater production rate and the hydrogeological data, it is evident that Subsystem N does not have a infiltration problem and has only a slight amount of inflow. An average rainfall event increased the flow only 5,000 gallons per day. Therefore, Subsystem N was classified a Phase III infiltration area and a Phase II inflow area.

It is recommended that approximately 6,050 lineal feet of sewer line be cleaned and televised as part of Phase II remedial work.

15. Subsystem O

Subsystem O, located in the southeast section of Town, is bordered to the north by Elm Street, to the south by Main Street, to the east by Colfax Street and to the west by the E. J. & E. Railroad. The wastewater flow from Subsystem O was isolated by metering in Manhole 52. (See Figure 3 for the exact subsystem location.)

The average dry weather flow for Subsystem O was excessive while the average wet weather flow was not. Based on the metering results, the theoretical wastewater production rate and the hydrogeological data, it is evident that Subsystem O has no infiltration problem. However, Subsystem O did respond to rainfall events with an increased flow of approximately 36,000 gallons per day. Therefore, Subsystem O was classified a Phase III infiltration area and a Phase II inflow area.

It is recommended that Manhole 0-17B be repaired and approximately 2,650 lineal feet of sewer line be cleaned and televised as part of Phase II remedial work.

16. Subsystem P

Subsystem P, located on the south end of Town, is bordered to the north by the E.J. & E. Railroad, to the south by Division Avenue (Avenue H), to the east by the Town's political boundary with Merrillville and to the west by Cline Avenue. The wastewater flow from Subsystem P was isolated by metering in Manhole 53. (See Figure 3 for the exact subsystem location.)

The average dry and wet weather flow were excessive. Based on the metering results, the theoretical wastewater production rate and hydrogeological data, it is evident that Subsystem P has an infiltration problem. However, Subsystem P showed no response to rainfall events. Therefore, Subsystem P has been classified as a Phase I infiltration area and a Phase III inflow area.

Preliminary field inspections have revealed the following:

- Infiltration in the sewer line on the west side of Broad Street. (Note: The sewer is located in a storm ditch.)
- Heavy sediment in the interceptor line.
- Open grates on manholes within the plant site of the American Chemical Corporation.
- Sanitary landfill located next to the interceptor.

No repair or cleaning work has been performed in Subsystem P. However, the South Sanitary Interceptor Sewer Cleaning Project has recently been awarded.

The following is recommended:

- Repair Manholes P019, P-20, P-21 and P-22 as part of Phase I remedial work.
- An extensive field investigation.
- Clean and televise approximately 11,390 lineal feet of sewer line as part of Phase I remedial work.
- A cleaning of the interceptor.
- Manhole lid replacements on the American Chemical plant site.
- Monitors and grit traps on discharge streams from the landfill.

C. GENERAL ANALYSES AND RECOMMENDATIONS

1. Sewer Cleaning, Televising and Videotaping

Metering results indicate infiltration in Subsystems I & K. (For a review of the results, see above discussion for each subsystem.) It is recommended that Subsystems I and K be the first priority for cleaning, televising and videotaping.

2. Interceptor Cleaning and Manhole Repair

Field investigations of the interceptor at the south end of Town revealed varying sediments depths that were in the order of 1.0 foot. Sediment levels in this range could reduce the capacity of the interceptor. Reduced sewer capacity could result in unhealthy and unfavorable consequences. (i.e. Raw sewage surcharging in public areas.) In addition, several manholes along the interceptor were in disrepair. Several manholes exhibited infiltration through the joints of the rings.

The South Sanitary Interceptor Sewer Cleaning Project will clean the interceptor between Manhole 50 to Manhole 80. This project will proceed after material disposal issues are resolved. The project includes pipe sizes that consist of approximately 190 LF of 12" pipe, 2,634 LF of 21" pipe, 1,617 LF of 24" pipe, 1,341 LF of 27" pipe and 3,198 LF of 30" pipe. The total project consists of 8,980 feet of sewer. (Appendix J contains detailed plans of the recommended project.)

Interceptor manholes exhibiting infiltration, with the exception of Manhole 17, have been repaired. M S Enterprises was contracted to repair the infiltration at Manholes 7, 16 and 56. Meanwhile, Gatlin Plumbing and Heating, Inc. were contracted to repair Manholes 8, 9, 10, 11, 13, 14, 15, 21, 24, 25, 47, 53, 54, 56, 61, 63, 66 and 71. Appendix M documents the repair work.

Upon completion of the South Sanitary Interceptor Sewer Cleaning Project, the recommendation is to clean and televise approximately 13,500 lineal feet of sewer line and repair Manholes 10 and 18 as part of Phase I remedial work and that repairs to Manholes 13, 28, 74, 75, 77 and 78 be completed as part of Phase II remedial work.

3. Manhole Lid Replacement

Field inspections have revealed several manhole lids with drilled holes or open keyways. Considerable amounts of storm water could enter the system via these openings. The amount of inflow and seriousness of the problem, depends upon the following site conditions:

- Number of holes in the lid

- Size of holes in the lid
- The location of the lids

The most severe inflow problem due to openings in the lids is from drilled holes in the lids. Most of these manholes, located in Subsystem J and L, are situated in flood prone, residential areas. It is suspected that the holes were drilled in the lids to alleviate the flooding in these areas.

The second most severe inflow problem due to lid openings are keyway holes in lids that are located in the street. Additional problems occur when the manholes are located in the gutter.

Finally, a minor inflow problem results due to keyway holes in lids that are located in the tree line. (Assuming that the tree line is not in a flood prone area.)

The recommendation is that all lids with drilled holes eventually be removed and replaced with solid, gasket sealed lids. Most of these lids are in potentially flood prone areas. This work shall not be done without addressing flooding problems which could possibly occur. Site investigations have suggested that the primary cause of flooding in Subsystems J and L are due to the lack of storm sewer capacity. It is recommended that a storm sewer study of the area be completed.

It is believed that some manhole lids with open keys are a potential source of inflow. The recommendation is to selectively replace lids.

4. Improper Connections

Extraneous flow in sewers can be attributed to improper user connections to the sewer. Such connections include, but are not limited to the following:

- Residential and industrial sump pumps.
- Foundation drains
- Roof drains / eaves
- Basement drains

Improper connections can be a source of clear water inflow into the system. It is suspected that such connections will be difficult to locate. Metering results can isolate problematic subsystems, but identifying exact connections is difficult. Due to the difficulty in locating improper connections, the recommendation is to eventually implement an Improper Connection Program. This program should be centered around the following location methods.

- Visual inspection

  Any improper connection program should begin with an aggressive visual inspection phase. Trained personnel should inspect sump pumps, basement drains, roof drain and eavespots.

  Citizen cooperation is essential to the smooth and successful completion of this program. Prior to any inspection, polite and detailed letters should be sent requesting cooperation.

- Smoke testing

  Smoke testing for difficult-to-locate connections should follow the visual inspection. Residents should be alerted to the process through a rigorous public relations program. In addition, all smoke testing should be done using safe, non-toxic materials.

  Upon locating and documenting improper connections, work should proceed to correct the problems. A list should be comprised of all contractors that the Town deems qualified.

  Residents will be responsible for obtaining a Town approved contractor to correct the problem on his/her property.

  Due to the intense use of manpower necessary to identify this problem, it is recommended that it be spread over a 10 year period.

5. Construction Inspection

A thorough construction inspection program should eventually be established to enforce Town sanitary codes. This program should verify that new construction is properly connected to the Town's sewer system. In particular, it should verify that:

- all laterals are properly constructed and connected to the Town's sewer in accordance with local and state plumbing codes.
- the location of all laterals are properly mapped and recorded.
- all sumps, roof drains, basement drains and foundation drains are properly constructed and connected to the Town's storm sewer.
- the location of all sumps, roof drains, basement drains and foundation drains are properly mapped and recorded.

6. School Inspections

It is recommended that all schools, public and private, eventually be flow metered and dye-water tested. Metering the flows from the schools will provide accurate flow records that will help determine base line flows. The recently revised Sewer Rate Ordinance allows the Town to require the outside user to install the metering equipment at their expense. Dye-water testing will assure that the schools' storm lines are properly connected to the sanitary and storm systems, respectively.

7. Outside User Inspections

The Town of Griffith has utility accounts with a small number of outside sewer users. At the request of the Town, field investigations and inquiries have been conducted to locate the sewer lines which transport the wastewater from these users. Currently, seven outside users have been documented: Black Oak Elementary School, Longfellow Elementary School, Midstates Distributors, Ross Church, Lake Ridge Middle School, Calumet High School and Strack & Van Til. (See Figure 5 for the location of five of the seven users.)

It is recommended that all outside users eventually be flow metered and dye-water tested. Metering the flows from the outside users will provide accurate flow records that will help determine base line flows. Dye-water testing will assure that the outside users' sewer lines are properly connected to the sewer system.

8. Preventive Maintenance

A well-organized Preventive Maintenance Program is an effective way to keep the sewer system operating smoothly and effectively. Furthermore, a Preventive Maintenance Program tends to find and correct problems prior to developing into expensive crisis problems.

9. Routine Maintenance

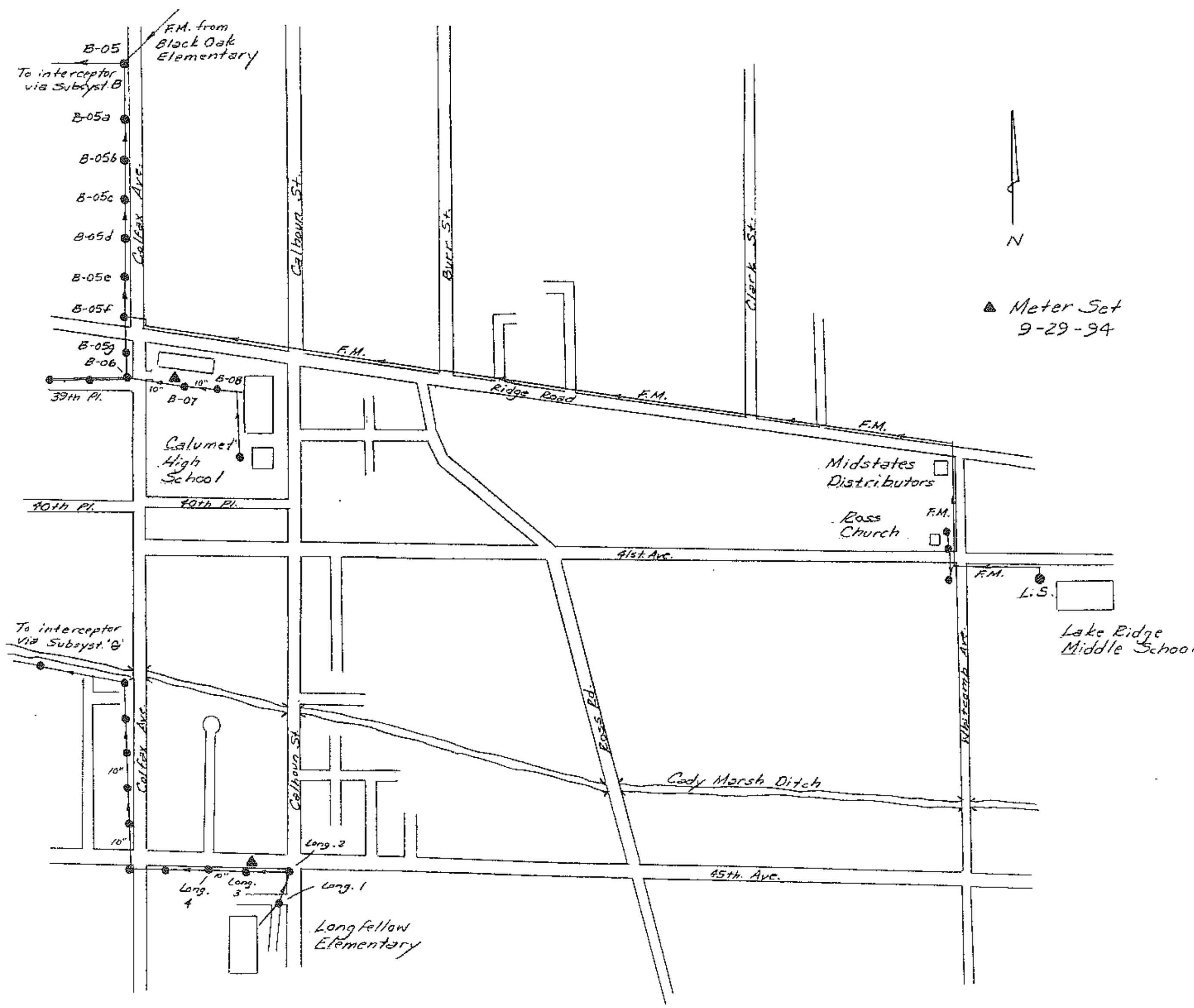
An effective means of identifying sewer problems is the routine inspection of the system by properly trained personnel. The following is a list of recommendations.

- Implementation of a detailed inspection program for all sewer manholes.

  This program should be organized so that manholes located on the interceptor are inspected in the first year, the manholes located on the main trunk lines are inspected in the second year and the manholes located on the laterals are inspected in the subsequent years. (It may be feasible to inspect both the manholes on the interceptor and the main trunks in the same year.)

FIGURE 5

OUTSIDE USERS



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Each time a manhole lid is opened, a manhole inspection sheet should be carefully completed and recorded.

- Implementation of a Flow Monitoring Program.

  It is recommended that meters and rain gages be installed at all pump stations. Permanent pumping records are essential in establishing reliable base line flows.

- Implementation of a detailed map updating program.

  This program should be established with personnel that are able to update all changes to the sewer system. Permanent and reliable sewer system records are imperative for future reference.

D. COST ESTIMATES

1. Phases I & II

Tables 2 & 3 summarize work recommended to be performed in each subsystem for Phases I and II, and the estimated cost for the work which includes manhole repairs, storm sewer projects and cleaning and televising of sewer lines. Smoke testing should also be performed if required and as appropriate during improper connection surveys.

The remedial work has been broken down into two phases. Phase I is the work which should be completed first. Phase II is important but not quite as critical and should be performed as soon as funding allows. A suggested detailed work schedule is shown in Section VI.

Phases I and II discuss cleaning and televising selected lines of various subsystems. This will be very costly if outside contractors are used for all of this work. It is recommended that the Town of Griffith purchase or rent televising equipment to perform this work with Town personnel, if possible. It is recommended that a program be set up to televise, say 10% of the major trunk lines each year with emphasis in the beginning years placed on the subsystems discussed in Phase I, then Phase II and eventually any others remaining. This approach would allow the Town to clean and televise a greater area for less cost. An outside contractor would probably need to be hired to clean and televise the interceptor due to the accessibility problems and the need for specialized equipment.

Table 2

Town of Griffith, Indiana - Remedial Work Phase I

Phase I	Repair Manholes (Each)	Total Cost @ $900.00 Each	Clean & Televise (Lineal Foot)	Total Cost @ $2.35/ LF	Special Televising @ $11.00/LF	Storm Sewer Project	Miscellaneous (Lump Sum)	Total Cost
Interceptor	2	$1,800	13,500		$148,500			$150,300
Subsytem A	1	$900						$900
Subsystem B	1	$900					$5,000 *	$5,900
Subsytem C	1	$900						$900
Subsystem D								$0
Subsystem E								$0
Subsystem F	1	$900						$900
Subsystem G	1	$900						$900
Subsystem H			30,010	$70,524			$5,000 **	$75,524
Subsystem I			7,320	$17,202				$17,202
Subsystem J			13,000	$30,550		$420,000		$450,550
Subsystem K	6	$5,400	14,655	$34,439				$39,839
Subsystem L	11	$9,900	21,220	$49,867				$59,767
Subsystem M								$0
Subsystem N								$0
Subsystem O								$0
Subsystem P	4	$3,600	11,990	$28,177				$31,777
Non - Sewer Users	1	$900						$900
Administration, Eng. and Inspection								$79,700 ***
Total	28	$26,100	111,695	$230,758	$148,500	$420,000	$10,000	$915,058

* Cost includes installation & maintenance of meter.

** Cost includes identifying and plugging sanitary lines in wetland area.

*** Engineering costs include plans and specifications only.

Table 3

Town of Griffith, Indiana - Remedial Work Phase II

Phase II	Repair Manholes (Each)	Total Cost @ $900.00 Each	Clean & Televise (Lineal Foot)	Total Cost @ $2.35/ LF	Special Televising @ $11.00/LF	Storm Sewer Project	Miscellaneous (Lump Sum)	Total Cost
Interceptor	6	$5,400						$5,400
Subsytem A			2,580	$6,063				$6,063
Subsystem B	1	$900						$900
Subsytem C			1,600	$3,760				$3,760
Subsystem D			1,600	$3,760				$3,760
Subsystem E			1,350	$3,173				$3,173
Subsystem F	1	$900	4,820	$11,327				$12,227
Subsystem G	5	$4,500	5,498	$12,920				$17,420
Subsystem H	3	$2,700						$2,700
Subsystem I								$0
Subsystem J								$0
Subsystem K	4	$3,600						$3,600
Subsystem L	12	$10,800				$620,000		$630,800
Subsystem M	1	$900	4,500	$10,575				$11,475
Subsystem N			6,050	$14,218				$14,218
Subsystem O	1	$900	2,650	$6,228				$7,128
Subsystem P								$0
Non - Sewer Users	2	$1,800						$1,800
Administration, Eng. and Inspection								$68,200 *
Total	34	$32,400	30,648	$72,023	$0	$620,000	$0	$792,623

* Engineering costs include plans and specifications only.

Two significant storm sewer projects have been analyzed. These are:

a. Subsystem J

The installation of storm sewer inlets and storm sewer lines in Subsystem J will alleviate flooding of streets and yards thereby substantially reducing the amount of stormwater inflow into the Town of Griffith sewer system. The estimated cost for this project is $420,000.00. A copy of the cost estimate and detailed work plan is included in Appendix Q.

The amount of inflow to be removed from Subsystem J was estimated at approximately 6.4 million gallons per year based on metering data obtained and rainfall information from April, 1994 to March, 1995.

Rainfall	# of Events	Est.Volume/Event	Total Removed
1/2"	21	170,000 gal	3,570,000 gal
1"	6	300,000	1,800,000
2"	2	500,000	1,000,000
	Total =		6,370,000

This project will substantially reduce peak flows during storm events as well as reduce flooding of streets and yards in this area. We would estimate that peak flows would be reduced approximately 0.25 mgd or greater depending on the magnitude of the storm event.

b. Subsystem L

Subsystem L is similar to Subsystem J in that additional storm sewer lines and inlets are needed to eliminate stormwater from entering the sewer system and to alleviate flooding. The majority of this subsystem is without any storm sewers.

A hydraulic analysis of the storm sewer system in Subsystem L should be performed. From past investigations it would appear that the diversion chamber at the intersection of Brinwood Street and Arbogast Avenue may not be working as originally designed. Flow which exceeds the capacity of the 14" throttle exiting the chamber should be discharged into the Cady Marsh Ditch. However, the water elevation of the ditch prevents the flap gate from opening and a backwater effect develops. This problem should be alleviated prior to constructing any additional storm water lines in this area. A stormwater pump station might eventually be built.

The following is a preliminary cost estimate to correct the major problem areas in Subsystem L:

1.	Storm Sewer Inlets and Piping 60 Acres @ $8,000/Acre =	$ 480,000.00
2.	Storm Water Pump Station -	$ 100,000.00
3.	Engineering -	$ 40,000.00
	Total =	$ 620,000.00

Examination of the metering data for this subsystem reveals that a 1" rainfall produces approximately 300,000 gallons of inflow or 0.30 MGD. This is a large amount and should be eliminated. A hydraulic analysis should be completed prior to final design of remedial work in this subsystem.

c. Manhole Repairs

As discussed in Section V, paragraph A(6), repairs have been performed to 26 manholes within the Town of Griffith to reduce inflow and infiltration problems as well as replace manhole sections, install adjustment rings, etc. The cost for this work is approximately $27,000.00. The estimated reduction in flow ranges from 10,000 gallons per day as infiltration on dry weather days to 200,000 gallons per day as mostly inflow during wet weather days.

2. Phase III

As with Phase I and Phase II, a cost effective analysis will be prepared for infiltration rehabilitation work after review of information received from the cleaning and televising of selected lines within the sewer system. It should be noted that the Town of Griffith recently requested additional capacity from the Sanitary District of Hammond to increase the amount of sewage which the Town can send to the District to a rate of 5.5 MGD. A resolution was passed by the Board of Commissioners of the Sanitary District of Hammond authorizing the additional capacity on June 6, 1996.

The Town of Griffith will also construct a new pumping station, equalization basin and force main over the next few years. When complete, in addition to being able to now pump 5.5 MGD to the Sanitary District of Hammond, the facility will be more reliable and will have a storage capacity in excess of four (4) million gallons which can be utilized during storm events.

Phases I and II address primarily inflow problems. Phase III will concentrate more on infiltration reduction and will recommend remedial action on a cost effective basis as discussed above.

VI. DETAILED WORK SCHEDULE

Figure 6 shows a proposed detailed work schedule for the completion of work as detailed in Section V - Remedial Action, based on a start date of June 1, 1995. Other investigations will be performed during the next several months which may reveal additional corrective work which may be performed. Future remedial action projects will be added to the schedule if they are determined to be cost effective as discussed above.

FIGURE 6

TOWN OF GRIFFITH
SEWER SYSTEM EVALUATION SURVEY
DETAILED WORK SCHEDULE